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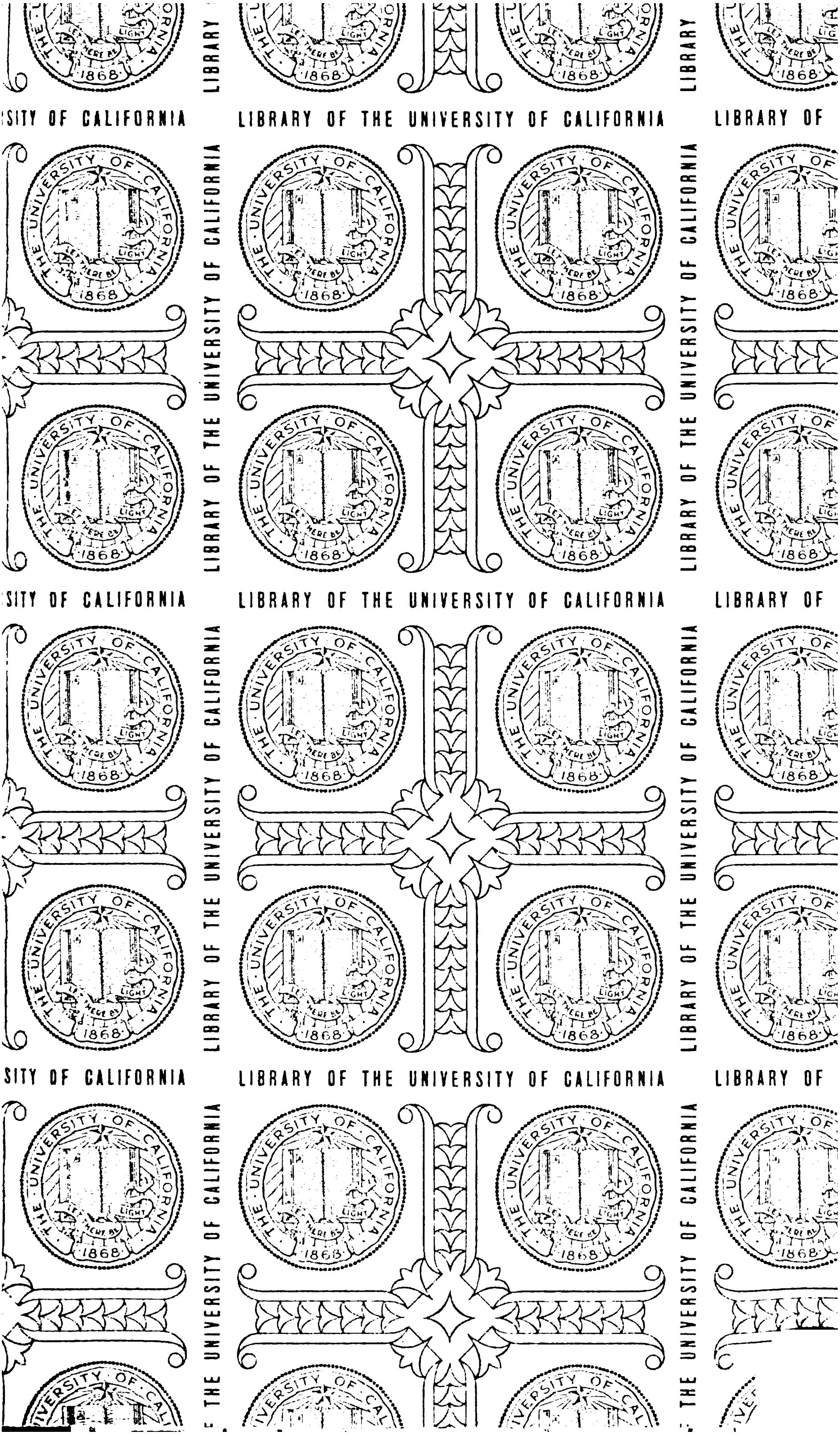
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#17

DEPARTMENT OF AGRICULTURE.

ARTESIAN WELLS

UPON THE

GREAT PLAINS;

BEING

THE REPORT OF A GEOLOGICAL COMMISSION APPOINTED TO
EXAMINE A PORTION OF THE GREAT PLAINS EAST OF
THE ROCKY MOUNTAINS, AND REPORT UPON THE
LOCALITIES DEEMED MOST FAVORABLE FOR
MAKING EXPERIMENTAL BORINGS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1882.

[Report # 19]

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LETTER OF TRANSMITTAL.

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Hon. GEORGE B. LORING,
Commissioner of Agriculture:

SIR: Having been appointed by you a commission to make scientific examination of certain arid lands of the United States east of the Rocky Mountains, for the purpose of indicating suitable localities for boring experimental artesian wells, we have the honor to present the accompanying report of the results of our examinations during the season of 1881.

The region within which we were expected to operate, as indicated by your general instructions, is a very large one, the area and boundaries of which we understood to be as follows: All that area which lies between the meridian of 102° on the east and the base of the Rocky Mountains on the west, and between the northern boundary of the United States on the north and the southern boundary of the same on the south.

The season was so far advanced before we were able to begin our labors in the field that the necessity for confining them during the comparatively short time that field work would be practicable to a limited portion of the great area above indicated became at once apparent. Accordingly we selected that portion of Colorado which lies east of the Rocky Mountains as the field of our labors for the short season that remained, and received your approval of the same. Under ordinary circumstances it would have been impracticable for us to make such an examination of this large district within a time so limited as would warrant a conclusive report upon the subject required. But owing to the fact that both of us had, on former occasions, examined large portions of this district in such a manner as to make the results available for the purpose of this commission, we have been able to arrive at conclusions that, so far as a belief in their approximate accuracy is concerned, are to a considerable degree satisfactory to us.

It would have been much more agreeable to us if we had found ourselves able to make a report which would encourage a confident hope of abundant success as the result of such experimental borings within this district as were contemplated by the act of Congress authorizing the work upon which we have been engaged. The conclusions we present are, however, those to which we have felt ourselves compelled to arrive, and in support of those conclusions we also present the data upon which we have based them, that others may judge of their accuracy or fallacy as well as we.

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We desire in this connection to say that while a large part of the facts and conclusions which we present in our report will apply with equal force to the whole arid region of the plains, we have purposely confined our report to the region we have designated. Success or failure in artesian borings depends primarily on geological structure, and that structure may be more favorable in places outside of our district than we have found it to be within it. A correct knowledge of that structure being attainable only through a careful investigation by skillful geologists, we venture to recommend that all future work of this kind be assigned to the United States Geological Survey.

Respectfully submitted.

C. A. WHITE,
SAMUEL AUGHEY,
Commissioners.

WASHINGTON, D. C., *February* 7, 1882.

ARTESIAN WELLS UPON THE GREAT PLAINS.

REPORT OF THE COMMISSIONERS.

INTRODUCTORY REMARKS.

While this report embraces a consideration of only a small part of the great arid area of the West, the district to which it refers, namely, that portion of the State of Colorado which lies east of the Rocky Mountains, is nevertheless of considerable size, embracing as it does about 40,000 square miles.

The principal features of this large district, as well as those of the large areas that adjoin and are continuous with it both upon the north and south, are very simple, the whole region referred to being, in fact, one of the well-known great plains of the earth, the general uniformity of which is seldom broken by any considerable local elevation of the surface. It is, however, bounded on the west by the abruptly rising principal chain of the Rocky Mountains, some of the peaks of which reach an altitude of over 14,000 feet above the level of the sea. By reference to the lists of elevations along the lines of railway that traverse it from east to west, the surface of our district is found to have a general slope to the eastward from near the base of the Rocky Mountains of from 10 to 12 feet to the mile. Roughly calculated, the average elevation of the district above the level of the sea, exclusive of the locally elevated areas near the mountains, which we have designated as Tertiary highlands, is about 4,450 feet; the lowest point within its borders, which is where the Arkansas River crosses its eastern boundary, is 3,129 feet.

In consequence of this easterly slope of the surface, the two principal rivers of the district, the Arkansas and South Platte, traverse it in an easterly direction, the distance from the base of the mountains to the eastern border of the district being fully 150 miles. After assuming this almost easterly course upon the plains, both these rivers not only receive almost no accession to their volume of water during the summer season, but their volume in summer time is often actually lessened by evaporation and absorption as they flow to the eastward upon the plains. Their constant supply is derived from their numerous branches, which head among the Rocky Mountains. These facts, together with others which will be brought out upon the following pages, show the great aridity of the district during at least a portion of each year.

During the prosecution of our investigations we found it convenient to divide the general subject under three principal heads, namely: (1) the general topography and surface features of the district; (2) the geological structure of the district and of the adjacent mountains; and (3) the primary sources of water supply in and around the district. In the presentation of our report we shall follow the same divisions of the subject, and add (4) a brief history of the attempts that have been made by various parties in and near the district to procure water by means of artesian borings, and (5) a statement of our conclusions and recommendations.

We shall also add, as appendices to the main subject of our report, (6) a statement of the results of incidental observations concerning available sources of water supply within the district other than that which may be hoped for by means of artesian wells; and (7) the special report which we have already presented upon the artesian boring that has been made near Fort Lyon, Colo., under the auspices of the department.

TOPOGRAPHY AND SURFACE FEATURES.

This district being a portion of the great plains, its topography, as before indicated, is very simple, the surface of the plain within the limits of the district having, as has already been stated, a general slope to the eastward of from 10 to 12 feet to the mile; but this, while it is quite sufficient for complete and rapid surface drainage by means of its rivers and their tributaries, is too slight to be detected by the eye. The great chain of the Rocky Mountain system, made up of a compact mass of crowded peaks and gorges, rises almost as abruptly as a wall along the whole western border of the district. Within that portion of the great continental mountain chain, towering above the others, are some of the most noted peaks to be found within the limits of the United States; and no part of that great chain is more compact and characteristic than is that which borders the district upon which we here report. At the base of and closely against the eastern mountain front is a comparatively narrow fringe of foot-hills, the larger ones of which would elsewhere be regarded as mountains, but in the presence of the mighty members of the chain they hold a subordinate place. While even the higher peaks of the great chain do not reach an elevation that in full exposure to the influence of the sun would be above the true line of perennial snowfall in that latitude, there is a multitude of limited perennial snow-fields in the less exposed places among those mountains, some of which have an elevation of 3,000 or 4,000 feet less than that of the higher peaks; and dwellers in the adjacent plains are never out of sight of the white glitter of these interesting features of mountain scenery. From these numerous small snow-fields and the comparatively abundant rains that fall upon the mountains and not upon the plains, in summer time, multitudes of rivulets arise. These rivulets gather and unite in the gorges and find their way out upon the plains in the form of rapid streams, all of which are quickly gathered together to form, respectively, the two principal rivers of the district, the Arkansas and South Platte.

In consequence of retreating bends to the westward in the course of the eastern front of the mountain range towards the southwestern portion of our district, a part of the mountain streams which unite to form the Arkansas River do not before their confluence enter the proper limits of the district; but those which unite to form the South Platte all effect their confluence upon the plains, not only within the district, but within a distance eastward from the foot-hills of the mountains not exceeding twenty miles. All these mountain-born streams are constant and copious in their flow, even all through the summer, but some of the smaller ones which make their exit from the mountains and foot-hills with a copious flow of water have their volume greatly diminished, and in some cases wholly obliterated, upon the plains in summer-time by the rapid evaporation which occurs there in consequence of the dryness of the earth and atmosphere. Also, the numerous streams which are represented upon the maps in common use as tributaries of the South Platte and Arkansas, respectively, and which have both their source and debouchment upon the plains, are all either dry during the summer-time or they are reduced to a few isolated pools. During this portion of the year one may traverse these channels from mouth to source, and find a part of them as dry throughout their entire length as are the plains on either side of them; or, approaching the mountains in some of these dry channels, he may gradually come upon constantly flowing streams of pure and good water which is all lost long before the mouth of the stream is reached. During a portion of the spring and autumn, however, all the streams of the plains are broad and strong torrents of muddy water.

Traversing the great plains, of which our district forms a part, the general aspect of the surface is found to be similar to that of the great prairie regions of the States of the Upper Mississippi Valley. It is utterly treeless everywhere, except that a few clumps of cottonwoods and willows are found at the river margins, and rarely some scattered cedars occur in rocky ravines that sometimes cut the valley sides. Grasses of the most nutritious character for grazing, and various other herbaceous plants prevail, but vegetation does not cover the surface nearly so thickly as it does upon the prairies. The frequent and often abundant prevalence of cactus and other plants which are characteristic of arid regions also gives a desert-like aspect to the whole landscape in summer-time, when the fresh vegetation of spring has withered away. The soil of the plains is evidently much the same in character as that of the prairies, and tests that have been made of its capacity show that it only needs the seasonable application of water to make it quite as fertile.

In the vicinity of the mountains within this district we find two areas which have a distinct and considerable elevation above the great general level of the plains, and which, while they are near the foot-hills of the mountains, are quite distinct from them. One of these elevated areas lies north of the South Platte and between that river and Lodge Pole Creek. The other, which is much the larger area, lies to the southward of Denver, and between that city and Colorado Springs. The limits and characteristics of these Tertiary deposits will be explained under the head of geology. As we shall have occasion to make further references to these limited elevated areas as separate from the great general surface of the plains, we shall in this report designate them as the Tertiary Highlands; but it is proper to remark that this name is proposed not for general use, but only for conventional use in this report.

The borders of the more northerly of these Tertiary highlands are generally so well defined that they are readily recognizable from a distance on the plains, because they often assume the form of more or less abrupt bluffs, from 100 to 200 feet high, and they are sometimes made still more conspicuous in the monotonous landscape by occasional clumps of cedars or scattered trees of that kind which grow upon their crests or slopes. The more conspicuous of these bluffs have received local names, such, for example, as the "Chalk Bluffs," just upon the northern boundary of our district and some 25 miles southeastward from the city of Cheyenne.

The more southerly of the Tertiary highland areas is the larger and much the more elevated, the higher portions reaching an elevation of 600 or 800 feet above the general level of the adjacent plain. But its boundaries are not so clearly defined by precipitous bluffs as those of the northern area; its general surface is more uneven, being divided by erosion into numerous hills and ravines; and considerable portions of the area are occupied by somewhat scattered small bodies of timber, mostly pines and cedars. In some sense these hills partake of the character of foot-hills of the adjacent mountains, but they are separate from and lie just east of the foot-hills proper.

These Tertiary highlands are specially noticed in this report, not so much because they are conspicuous topographical features of that strongly featured region as because in the letter of instructions which we received when entering upon the work the wish was expressed tha we should learn as far as practicable the probabilities of obtaining wate by means of borings of comparatively little depth in the superficial an Tertiary deposits. The character of the Tertiary deposits will be furthe elucidated under the head of geology of these districts, and the bearin of their structure upon the special subject of this report will be considered under the head of conclusions.

Aside from these Tertiary highlands, there is nothing in our large district to break the monotonous undulation of the general level of the plain except the shallow and usually broad valleys of the water-courses, al of which have a good degree of uniformity of character throughout thei entire length; but the sides of the smaller valleys blend with the undu lations of the plains at their upper portions. Like the higher surface c the plains, the valleys are all destitute of trees, with the unimportant exceptions that have before been noticed. The valleys of the South Platte and Arkansas are similar to each other in general characteristics across the whole breadth of the district. Their sides slope so gently down from the uplands or higher general level of the plain that it is almost everywhere difficult to say where the valley side ends and the higher land of the plains begins. There is usually a considerable space at the bottom of the valley upon one or both sides of the river which to the eye appears nearly level, but which, as a rule, has a gentle slope towards the river, sufficient for its complete drainage. These valley bottom lands are generally of such a character and breadth that they would make admirable farms if they were only supplied with water at seasonable times. Upon the lowermost of these bottom lands the moisture derived from their proximity to the river is sufficient for the abundant growth of valuable grasses, which are now annually cut for hay.

GEOLOGY OF THE DISTRICT.

The geology of that portion of the great plains which constitutes the district upon which this report is based, like its topographical features, is very simple. The strata which underlie it have one broad but very gentle general dip to the eastward, away from the mountain chain, which dip is practically coincident with the general slope of the surface, which has already been described. Furthermore, this dip and the general slope of the surface to the eastward both coincide with the general slope of the two principal rivers of the district, the South Platte and the Arkansas, the course of both of which upon the plains is in the same direction. The general features of the geology of this district and that of the adjacent mountain region are well shown in the atlas of Colorado which has been published by the United States Geological Survey of the Territories. A copy of a part of one of the sheets of that atlas accompanies this report, containing such additions by us as we have thought necessary for the elucidation of the subject in hand. Certain of the minor geological details which cannot be clearly shown upon the map, especially the secondary undulating dips of the strata of the plains, which we regard as having an important bearing upon the question of artesian water supply, were worked out by us during the past season.

The great axial mass of the Rocky Mountain chain which lies adjacent to our district consists of unstratified archæan rocks, a large part of which are granitic in composition. The plains in the region which embraces the district upon which we report are underlaid by different formations of stratified rocks, which formations in the vicinity of the mountains are known to range in the geological age from the Triassic to the Tertiary, inclusive. At certain places among the mountains and foot-hills which adjoin our district upon the west a few isolated portions of Silurian and Carboniferous formations have been discovered, but the development of these paleozoic rocks is so slight that for our present purposes we do not think it necessary to make anything more than incidental reference to them. All the other formations here referred to, except the Tertiary, are abruptly flexed up against the archæan axial nucleus of the mountains, and enter largely into the structure of the narrow range of foot-hills of those mountains. Many of these foot-hills, being composed of the upturned harder and softer stata of the formation just mentioned, have been so shaped by erosion that they form more or less sharply angular longitudinal ridges, which are commonly designated as hog-backs. It is among the foot-hills, where the stratified rocks are upturned, that the latter are to be seen and studied to best advantage, because out upon the plains the higher formations of the series cover the next underlying ones successively, and, except at occasional exposures, even the uppermost ones are covered, as with a mantle, by the superficial deposit or *débris* of the plains. This *débris* is really that which has been derived from the easily disintegrated underlying rocks, and which, mixed with gravelly fragments that have been derived from the mountains, constitutes the soil and subsoil of the plains.

The Tertiary strata of this district were no doubt once flexed up against the mountains like those of the formations which underlie them, but perhaps to a considerably less extent than those; but they have been removed by erosion from those rocks which once underlaid them and now enter into the structure of the foot-hills. Those Tertiary rocks no doubt also once extended far out upon the plains, covering large areas there; but with the exception of the two limited areas that we have already described as the Tertiary highlands, which are composed of those strata, they have all been removed by erosion from the plains portion of our district also.

The following is a tabular statement of the whole series of formations of stratified rocks which pertain to the district here reported on, except the small Silurian and Carboniferous deposits which have before been mentioned. Opposite the names of each group is placed the approximate thickness in feet which they respectively attain in the western part of the district, the measurements having been taken where the strata are upturned against the mountains:

		Feet.	
Tertiary		200 to 1,400	
Laramie		200 to 1,000	
Cretaceous	Fox Hills Groups	1,200 to 1,500	2,250 to 2,900
	Colorado Groups	800 to 1,000	
	Dakota Groups	250 to 400	
Jurassic		400 to 800	
Triassic		1,500 to 2,000	
Total		4,550 to 8,100	

Tertiary deposits.—The deposits which we have designated as of Tertiary age are not now, as before stated, flexed up against the mountains, but their western borders are very near to the foot-hills. The more northerly of the two areas within the district lies just upon its northern boundary, and extends out upon the plains some 75 or 80 miles to the eastward from the foot-hills within the district, and still further eastward in the district which lies just north of it. The more southerly of the two Tertiary areas is some 50 miles across from east to west, and about 40 miles across from north to south. The strata of both these Tertiary deposits are all approximately level, or they dip slightly to the eastward, like those upon which they rest.

While the strata of both the northern and southern Tertiary highlands here referred to undoubtedly belong to the Tertiary period, and are as undoubtedly of fresh-water origin, it is understood by us that those of the two areas, respectively, are not referable to one and the same epoch of the Tertiary period. But they both rest directly upon the Laramie Group, and the lithological character of the one being closely like that of the other, they are practically one for our present purpose, which is only to show the bearing of the geological structure of the district upon the question of water supply by artesian borings within its limits. The areas occupied by those Tertiary deposits are represented by the spaces on the accompanying geological map which are colored plain yellow and marked by the letter T.

These Tertiary deposits of both areas are largely made up of friable sandstones, sandy shales, and conglomerates, with very few clayey layers, and also some strata of more or less compact sandstone. They contain comparatively few layers that are impervious to water or that would materially obstruct its percolation through the whole formation.

Laramie Group.—This group of strata constitutes the coal-bearing formation of Colorado east of the Rocky Mountains. It has, in our district, a maximum thickness of about 1,000 feet; but over a large part of the district its strata are reduced by erosion to 100 to 200 feet in thickness, and upon the borders of the river valleys it has been thinned out entirely by erosion, which has also here and there laid bare the underlying Cretaceous strata.

This formation is shown by the character of its fossil remains to have been of brackish-water origin; and we regard it as holding a transitional position between the strata of Cretaceous and Tertiary periods proper, in its biological characteristics partaking of both. It is quite uniform over the whole district in its lithological characteristics, being made up largely of clayey strata, which are more or less sandy, and occasional sandstones and sandy shales, all of which are usually more or less calcareous. Therefore, as a whole, it is evidently a formation through which water could work its way slowly if at all by percolation, although a few of its layers are so sandy and slightly compacted that water might apparently percolate through them with some facility if it were not obstructed by the impervious layers above and beneath them.

The strata of the Laramie Group occupy a greater portion of the area of the district immediately beneath the superficial deposit than those of all the other formations together; in consequence of which, and of its lithological characteristics as already described, it has a very important bearing upon the questions to be discussed in this report. The area occupied by the Laramie Group is shown by the spaces upon the accompanying geological map which are colored by green, circular dots on a yellow ground and marked by the letter L. Although the flexed condition of the strata of this group, in the immediate vicinity of the mountains, shows that they were all originally upturned to an equal extent with the others which underlie them, they are now not often found to enter into the structure of the foot-hills proper. This is without doubt due to the fact that the Laramie strata, being as a rule comparatively soft and friable, have been removed by erosion wherever they have been prominently exposed by reason of the upward flexure, while the harder strata of the formations beneath them remain in the form of the prominent hog-backs among the foot-hills that have already been described.

Cretaceous formations.—The strata of marine origin which are referable to the Cretaceous period are in Colorado divisible into only three distinct groups,* namely, the Fox Hills or Upper, the Colorado or Middle, and the Dakota or Lower. All three of these groups are flexed up together against the mountains, and all three of them enter to some extent into the structure of the foot-hills. Upon the plains the Cretaceous strata, like all the others, being in nearly a horizontal position, do not produce any prominent features in the landscape.

Next to the Laramie Group, the strata of these three Cretaceous groups occupy a greater portion of the surface of the district than any other. Upon the plains they are exposed in the valleys and vicinity of the rivers and their larger tributaries; and the areas which they occupy are represented by the spaces on the accompanying geological map, which are colored green and marked by the letters Cr.

The lithological characteristics of these three groups, as well as those of the others yet to be noticed, have an important bearing upon the question of artesian water supply.

The Fox Hills Group is composed in large part of bluish clayey strata, somewhat arenaceous for the upper portion, and sandstones and sandy shales for the lower portion; but among the latter are many soft and some clayey layers.

The Colorado Group is composed very largely of argillaceous shales, and toward the base these shales are somewhat firm and calcareous, and often fissile. This description applies more particularly to the northern portion of the district, but in the southern portion this group is much more calcareous than in the northern, and near its upper portion there are many layers of firm, regularly-bedded, gray limestone. As a whole, the Colorado Group is one that will evidently not allow the free percolation of water through it. Indeed, it is evident that this group would present great obstruction to the percolation of water.

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* See Annual Report U. S. Geol. Sur. Terr. for 1876, p. 29.

The Dakota Group is largely made up of coarse, rough layers of more or less firm sandstone, and although a considerable portion of it is soft, and sometimes clayey, it is perhaps more pervious to water than any of the other formations which underlie the district. These sandstones are therefore regarded as presumably water-bearing strata. It is one of the most uniform in its lithological characteristics of all the Cretaceous groups of North America.

Jurassic.—This is one of the thinner of the formations which underlie our district, averaging only 500 feet at its western border, where the formation is upturned among the foot-hills. It is composed mainly of argillaceous material, in the form of clayey and somewhat sandy shales, with occasional beds of impure limestone and sometimes small deposits of gypsum. As a whole, therefore, this formation is also one of the most impervious to water. Although it is evident that these Jurassic strata underlie at least all the western portion of our district, none of them are exposed at the surface within its limits, but the whole formation is upturned among the foot hills, where, being composed of easily eroded material, it usually occupies the longitudinal valleys which are bordered on either hand by the hog-backs of the Dakota and Triassic groups respectively.

The limited area within which the strata of this group are exposed at the surface is too small to be represented alone, and it is therefore included in the very narrow, irregular, interrupted purple stripe upon the accompanying geological map, marked by the letters J. T., which also includes the Triassic strata.

Triassic.—Although—as is shown by the narrow space upon the map which has just been mentioned—this formation occupies a very narrow area of the surface, it is the thickest, and in some respects one of the most important of the formations which we have occasion to discuss. It has an average thickness of about 1,700 feet. It is composed mainly of sandstones, which are often coarse, and which sometimes alternate with layers of conglomerate. The nearly uniform red color that prevails throughout the formation almost everywhere has caused the common name of "Red Beds" to be applied to it. The sandstone layers are usually harder than those of the other formations, but still they are not very dense, and those alternate with softer layers, some of which are argillaceous. The greater part of the strata of this formation being harder than those of the other formations that have been described, they often form large and conspicuous hills among the foot-hills, many of which are in the form of huge hog-backs.

Like the Jurassic, none of the strata of the Triassic formation are exposed upon the plains, and therefore not within the limits of our district, and the foregoing description has been drawn wholly from the strata as they are seen among the foot-hills. That the formation real does extend far out from the mountains under the plains is, in our opinion, not to be questioned, and that the strata have the same general characteristics there may be legitimately inferred from the fact that those characteristics are very uniform wherever the formation is found at the surface on both sides of the Rocky Mountains. These inferences are also confirmed by the result of the boring that has been made near Fort Lyon.

This formation, composed as it is of sandy rock, would, if its strata were loosely compacted and regularly bedded, no doubt allow the ready percolation of water; but many of the strata are often found to be very dense, and many are also so argillaceous as to render it unlikely that much water could percolate through them. But the formation is a very thick one, and many of the strata would doubtless be permeable wherever a water supply may exist in contact with them. Therefore we shall regard it as like the Dakota sandstone—a presumably water-bearing formation.

The formations that we have here described constitute the whole series of stratified rocks that are known to underlie the district. The small local deposits of Silurian and Carboniferous strata, which are in a few places found among the foot-hills and the adjacent mountains, suggest that the same formations exist, to some extent at least, beneath the surface of our district, and consequently beneath the Triassic rocks. Possibly the last-named strata may there, at least in part, rest directly upon the archæan rocks, as they are seen to do in most cases at the foot-hills; but in any case the archæan rocks doubtless lie at a depth beneath the plains that will be beyond the reach of any borings that it will be found expedient to make there.

The only method by which the actual presence beneath the surface of the plains of any series of rocks older or lower than the Cretaceous can be demonstrated is by artesian borings. We may, however, to some extent, draw inferences as to the probable presence or absence of certain formations, respectively, beneath given portions of the district. For example, it is probable that beneath its eastern portion the Silurian and Carboniferous rocks are present and more fully developed there than they are at the foot of the mountains, because those rocks, as well as those of Devonian age, are well developed in the valleys of the Mississippi and Lower Missouri Rivers. Again, the Jurassic and Triassic strata, especially the latter, are, as has already been shown, well developed along the western border of the district; but neither of these formations are known to exist in the Mississippi and Lower Missouri Valleys, nor at any point between them and the eastern base of the Rocky Mountains. Therefore the inference is plainly correct that those formations have thinned out somewhere beneath the plains, and it is possible that they may have done so before they reached the eastern border of the district. It is also probable, or even practically certain, that the *Cretaceous* strata, except the Dakota Group, also materially diminish in thickness as they extend to the eastward. The same is evidently true of the Laramie Group, which doubtless thins out entirely in Western Kansas and Nebraska.

If, therefore, we should make a boring upon the plains within a short distance eastward from the Rocky Mountains we should expect, from our knowledge of the character and order of the strata as we find them flexed up against the mountains, that the drill would pass through the same formations and in the same order. The boring that has been made at Fort Lyon, Colo., under the auspices of the Agricultural Department, has really proved that this condition of things exists beneath the plains, 100 miles eastward from the mountains.

It is unfortunate, however, speaking from a geologist's stand-point, that the boring there was not carried down until the Triassic rocks were passed, instead of stopping, as it did, in those strata. This act, however, was plainly justified from an economic stand-point, as we have shown in our special report upon the subject.

If we were to make a boring upon the plains near the eastern border of our district, which is some 150 miles eastward from the base of the mountains, we might, from our knowledge of the broad, geographical extent of those formations, reasonably expect to find all the formations present there, from the Laramie to the Dakota Group, inclusive; and perhaps also the Jurassic and Triassic. It may be, however, that the two latter formations have entirely thinned out before reaching so far eastward; and it is quite certain that all the others, except the Dakota Group, which is known to exist in full force in Kansas and Nebraska, would be found to have become much thinner than they are at the base of the mountains. The question of the thinning or thickening to the eastward or westward of the formations that underlie the plains is a matter of practical importance, as well as of geological interest, as will be seen by our remarks under the head of conclusions. In this connection it should be stated that we have good reasons for believing that as a whole the stratified rocks which underlie the plains are much thinner at the eastern than at the western border of our district.

The unstratified archæan rocks of the Rocky Mountain region, and which it is assumed deeply underlie our whole district, appear at the surface within those areas which on the accompanying geological map are colored with a pink tint, and are marked with the letter M. They are such as are often designated as metamorphic rocks, and are similar in character to those which underlie the lowest stratified rocks elsewhere, so far as that character relates to the question of artesian water supply That is, not being stratified, we cannot calculate upon the course that water will take in passing through them, nor, indeed, can we think it probable that water will find its way by percolation through them beneath the surface to any considerable horizontal distance from the place where it falls from the clouds. It is true that springs are more or less frequently met with among that portion of the Rocky Mountains which lies adjacent to our district, issuing from the archæan rocks, and water is also frequently so abundant in the deeper mines of those mountains as to greatly impede the working of them.

This water is without doubt, in every case, derived from the rains and snows that fall upon the mountains in the immediate vicinity of the springs and mines referred to, and it has made its way to these outlets through the numerous irregular fissures which prevail in such rocks. These fissures, being irregular in character and direction and the rocky masses through which they pass being without stratification, the courses which those fissures may take cannot be calculated. Their irregular character, and the well-known character of the kind of rock through which they pass, renders it certain that however numerous these fissures may be they do not form continuous channels for the conduction of water to any considerable horizontal distance beneath the surface. While it is probable that water may percolate through the great mass of the unstratified rocks of the Rocky Mountains, and that some water may find its way thus and by means of fissures beneath the stratified rocks upon the plains in the immediate vicinity of the mountains, it is not to be expected that even small quantities of water should be thus conveyed beneath the plains to any considerable distance from its mountain sources. Practically, then, we think we are justified in regarding the unstratified archæan rocks as forming an impervious base to the stratified series of rocks within which, if anywhere, we may hope to obtain a water supply upon the plains by means of artesian borings.

We have already referred to the gentle general dip to the eastward from the base of the mountains of all the formations of stratified rocks which underlie our district. Although neither this easterly general dip nor the modifications of it which exist in various parts of the district are discernible to the eye, our acquaintance with the lithological and paleontological characteristics of the strata which are exposed at different points on the plains throughout the district, taken in connection with several series of elevations above the level of the sea that have been referred to has enabled us to reach conclusions that would not have been otherwise attainable. A portion of those series of elevations we have obtained from Gannett's published lists, and others have been furnished to us by the officers of the Union Pacific and Burlington and Missouri River Railroad Companies respectively.

The modification of the general eastwardly dip of the strata of the district which has been referred to consists of gentle undulations of the strata, which are so very broad and slight that they could not be detected, except by means of the railroad levelings that have been referred to and the surface slopes of the Arkansas and South Platte rivers. We have used the surface slopes of these rivers as base-levels by which to note the rise and dip of certain recognizable and persistent strata, above and below those levels, in the banks of the Rivers respectively. By means [illegible]e methods of observations we have ascertained that the Arkansas and South Platte Rivers each runs upon a very gentle anticlinal axis of the underlying strata, which axis extends across nearly or quite the whole breadth of the district. Consequently, there is a very gentle and very broad synclinal axis between the two rivers. The distance between the two rivers at the eastern portion of our district is about 180 miles, and the extent to which the strata are flexed downward between them there is estimated at about 400 feet.

The gentle undulations along north and south lines which the strata of the plains are found to possess, and which lie at right angles with the broad east and west anticlinals and synclinals that have been mentioned, have been explained in our special report upon the boring which has been made near Fort Lyon, Colo., under the auspices of the Department of Agriculture, and which is added to this report in the form of an appendix. No such undulations have been observed along the valley of the South Platte, and although they may exist elsewhere in the district than in the valley of the Arkansas River their presence has not been detected. Those undulations, as shown in the report referred to, have an important bearing upon the question of artesian water supply in the region of that valley. It will also be seen in the sequel that the broad synclinal between the two rivers of the plain, which has been explained, although so slight in the amount of its depression, is a very important geological feature in relation to the subject of this report.

The superficial deposits of the plains.—Before closing these remarks upon the geology of the district, further mention should be made of the superficial deposits or *débris* of the plains. This material, as already stated, is derived mainly from the immediately underlying stratified rocks, by their disintegration; but scattered among it, even as far out from the mountains as the eastern border of our district, are small fragments of granitic rock, which by its character is plainly seen to have been derived from the archæan rocks of the mountains. It was probably transported thence by the action of ice during the glacial epoch. This fine angular gravel sometimes, but seldom, is found in perceptible local accumulations upon the higher surfaces of the plains, but it is more perceptible in the valleys. Indeed, the larger valley bottoms are apparently all underlaid by material which consists largely of this loose drift-gravel. This condition of the ground makes the procuring of ordinary wells of good water at moderate depth in the larger valley bottoms of the district an easy matter in almost all cases.

PRIMARY SOURCES OF WATER SUPPLY.

In such districts as lie below the level of great lakes or other bodies of water that may exist in their vicinity, it is possible that an artesian water supply may be derived from such a source. In the region within which our district is located, however, no such source of supply can be considered, because no such bodies of water exist there nor in the regions round about, and no rivers traverse the district other than those

which have their rise in the adjacent mountains. Therefore, the only primary source of water supply to be considered in this report is that of rainfall.

For the purpose of showing the amount of water that falls upon the surface in and around our district, the following tables of rainfall are given, which have been compiled from the published reports of the United States Signal Office, the publications of the Smithsonian Institution, and Powell's Report on the Lands of the Arid Region of the United States. So few stations of observation have been located upon the more arid portions of the great plains that these tables do not really show the full extent of the contrast between those portions and the more favored region immediately to the eastward as regards the amount of rainfall, but these data are the most instructive of any that we have found available for our present purposes.

TABLE No. 1.—*Annual and monthly rainfall at certain points in Colorado, Wyoming, Nebraska, and Kansas, for the five years ending June 30, 1879.*

Localities.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
	1874.						1875.						
Pike's Peak	6.00	3.72	2.31	1.80	0.36	0.22	0.76	0.50	1.03	0.92	2.08	1.70	21.40
Denver	3.25	0.68	1.34	0.64	0.18	0.17	3.38	0.60	0.39	2.24	1.94	0.43	15.24
Cheyenne	1.87	0.44	0.93	1.86	0.04	0.16	0.42	0.06	0.23	0.50	1.20	0.29	8.00
* North Platte	2.48	2.42	0.85	1.46	0.57	0.34	0.24	0.26	0.40	6.21	1.69	1.62	21.24
* Dodge City	2.28	2.92	0.94	0.22	0.23	0.05	0.12	0.10	0.04	0.72	2.26	0.73	11.61
Omaha	0.54	2.08	7.18	1.45	1.05	0.54	0.26	0.51	1.24	3.06	4.25	10.95	33.11
Leavenworth	3.23	1.72	5.50	1.49	3.46	1.35	0.23	1.25	2.50	1.67	3.53	3.85	29.78
	1875.						1876.						
Pike's Peak	8.13	3.52	3.20	0.38	1.54	0.98	0.85	0.61	2.03	1.04	4.73	2.88	29.89
Denver	4.32	1.97	2.89	0.22	1.28	0.59	0.21	0.11	1.80	1.22	8.57	1.10	24.28
Cheyenne	4.47	2.12	1.34	0.60	0.84	0.03	0.02	0.06	0.54	0.23	2.50	0.10	12.85
North Platte	2.12	0.66	1.40	0.14	0.52	0.09	0.09	0.13	0.49	0.51	2.97	0.49	9.61
Dodge City	3.28	2.06	1.32	0.06	0.00	0.09	0.00	0.05	3.59	0.16	1.15	1.53?	14.29
Omaha	10.01	7.77	2.55	1.16	0.13	1.00	0.22	0.40	3.18	2.65	2.07	3.47	34.61
Leavenworth	8.82	3.73	1.97	0.72	0.39	2.60	1.42	0.20	5.78	7.65	6.78	5.71	45.77
	1876.						1877.						
Pike's Peak	2.20	4.63	1.60	1.45	1.06	0.79	1.49	1.29	1.53	2.91	2.82	3.36	25.13
Denver	1.16	2.03	0.60	0.12	1.50	1.70	1.90	0.40	1.40	2.77	2.30	1.93	17.81
Cheyenne	0.79	0.26	0.00	0.00	0.32	0.21	0.20	0.14	0.98	1.11	2.24	1.27	7.51
North Platte	1.16	2.46	1.47	1.07	0.49	0.51	1.38	0.37	0.19	0.37	3.22	2.99	15.68
Dodge City	2.26	1.03	2.13	1.00	1.35	0.15	0.18	0.56	0.25	3.38	4.96	3.92	21.17
Omaha	7.30	6.27	4.93	0.69	1.17	0.16	0.53	0.44	1.26	6.24	8.62	8.36	45.97
Leavenworth	4.01	3.40	3.56	2.79	2.87	0.31	0.73	0.50	4.39	7.14	8.67	10.00	48.37
	1877.						1878.						
Pike's Peak	2.70	2.10	2.69	3.74	0.54	0.41	0.29	1.45	2.95	3.77	4.82	8.49	28.45
Denver	0.33	1.30	0.38	2.15	0.73	0.79	0.10	0.48	1.82	0.05	2.90	2.78	13.81
Cheyenne	0.43	0.83	2.02	1.99	0.17	0.33	0.08	0.13	1.16	0.19	4.46	1.71	13.50
North Platte	2.04	5.03	4.49	1.23	0.30	3.86	0.00	0.18	1.40	1.15	3.24	5.85	28.77
Dodge City	1.79	4.09	0.50	3.34	0.56	4.36	0.21	1.13	1.01	1.06	4.63	2.19	24.87
Omaha	0.96	3.13	2.05	5.86	1.36	2.14	1.13	0.14	3.09	3.97	5.77	8.48	38.08
Leavenworth	5.34	2.85	1.95	4.87	2.44	3.18	2.34	2.94	2.35	2.86	5.28	5.27	41.67

TABLE No. 1.—*Annual and monthly rainfall at certain points in Colorado, &c.*—Continued.

Localities.	1878. July.	August.	September.	October.	November.	December.	1879. January.	February.	March.	April.	May.	June.	Total.
Pike's Peak	5.46	6.12	2.42	0.24	7.81	4.55	3.71	2.66	2.20	12.15	3.26	0.68	51.26
Denver	1.38	2.25	1.23	0.80	0.67	1.05	0.40	0.39	1.00	2.62	3.36	0.32	15.47
Cheyenne	1.43	2.50	0.75	0.04	0.00	0.19	0.32	0.20	0.44	1.66	1.30	0.07	8.90
North Platte	3.58	1.52	0.91	0.13	0.46	0.20	2.33	0.43	0.11	1.92	2.25	3.31	17.15
Dodge City	1.61	4.48	0.76	0.09	0.60	0.19	0.87	0.08	0.17	0.40	0.90	4.40	14.55
Omaha	7.66	2.48	3.22	0.55	0.29	0.27	0.07	0.93	2.17	1.77	5.53	4.09	29.03
Leavenworth	3.08	3.31	2.64	1.16	1.76	2.16	1.16	0.54	0.32	0.42	3.04	9.90	29.49

*The rainfall for July and August, 1874, was not recorded, and those entries in this table have been supplied by taking the mean of the rainfall for those two months in the other four years.

Mean annual rainfall for the five years ending June 30, 1879.

	Longitude.	Rainfall.
	° ′	*Inches.*
Denver, Colo	105 00	15.322
Pike's Peak, Colo	105 03	31.548
Fort Lyon, Colo	102 50	12.560
Cheyenne, Wyo	104 49	10.154
North Platte, Nebr	100 46	18.490
Dodge City, Kans	100 00	17.298
Omaha, Nebr	95 56	36.160
Leavenworth, Kans	94 52	39.018

TABLE No. 2.—*Totals of annual rainfall at Sidney Barracks, Fort McPherson, and Fort Kearney, Nebraska.*

SIDNEY BARRACKS.

Longitude 102° 58′.

	Inches.
1873	12.38
1874	14.77
Mean	13.58

FORT MCPHERSON.

Longitude 100° 30′.

	Inches.
1868	29.01
1869	10.08
1870	18.62
1871	20.04
1872	16.07
1873	18.86
1874	17.16
Mean	18.55

FORT KEARNEY.

Longitude 98° 57′.

	Inches.
1849	45.76
1850	25.07
1851	26.44
1852	20.65
1853	29.90
1854	26.65
1855	25.05
1856	29.10
1857	28.62
1858	26.14
1859	16.10
1860	16.85
1861	19.34
1862	22.10
Mean*	25.55

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*It will be seen that the data given for Fort Kearney, which are copied from the Smithsonian reports, end with the year 1862. It is claimed by some persons conversant with the facts, that there has been a material increase in the annual rainfall since that time, but we have not the data at hand which will indicate whether such an increase, if it really has occurred, is likely to be permanent.

The order of arrangement of the names of the stations of observation that are given in both the foregoing tables is from west to east; that is, the more westerly ones are given first, the object being to show the increasing amount of rainfall as one goes eastward from the said plains, until the region is reached where it is abundant for the purposes of agriculture.

The plains are arid up to the immediate base of the mountains, and the great mountain chain is surrounded upon all sides by an arid region. Upon the mountains themselves, however, as is well known, the rainfall is much greater than it is on the plains adjacent, or in the broad intervales which separate the subordinate chains that constitute the great Rocky Mountain system. This fact is clearly seen by comparing the rainfall upon Pike's Peak, as given in the foregoing table, with that of Denver and Cheyenne, both of which places are on the plains near to the mountains.

It would have been more satisfactory if we had found it practicable to obtain accurate data upon the whole of that portion of our district which lies to the eastward of a line between Denver and Cheyenne, but no stations of observation have been established there, so far as we are aware, except that of Fort Lyon. Sidney Barracks, however, lies just north of the northeastern portion of our district, and being located upon a continuation of the plains which include the district, its data will serve our purpose well in connection with the others. The data of that station, together with those of Denver, Cheyenne, and Fort Lyon, will, we think, give an average that will very nearly represent the mean annual rainfall for our district as a whole.

The mean annual rainfall for those four stations we find to be 12.905 inches; and in view of the fact that other records give the rainfall at Denver as a little greater than it is given in the foregoing table, we shall assume 13 inches to be the mean annual rainfall for our district.

A meridian 100 miles east of the eastern boundary of our district is generally regarded as at least approximately representing the western boundary of the great agricultural region which lies directly eastward from our district, beyond which to the westward the successful growth of farm crops is not practicable without irrigation. From that meridian the aridity increases until our district is reached, where the maximum occurs in that latitude upon the plains.

No station has been located exactly upon that meridian, but the annual average rainfall there is understood to be about 23 inches.*

The mean annual rainfall, as shown by the foregoing tables, is, at Fort Kearney, 50 miles eastward of the meridian referred to, 25.55 inches; and at Omaha, 215 miles eastward from it, 36.16 inches. We are aware that farm crops may be, and are, successfully raised without irrigation in regions where the annual rainfall is somewhat less than that which is here stated as the minimum, but where the rains fall at seasonable times. We, however, are only attempting to state the facts as they exist in relation to the great plains of the West; and our main object is to show clearly the increasing aridity of the climate as one goes westward from the region of the Missouri River to the Rocky Mountains.

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* We do not wish to be understood as in any way discussing the question of agricultural capabilities of the region here referred to. This question is one around which important interests gather, and one which requires more extensive and accurate data for its intelligent discussion than, in our opinion, yet exist.

Compare, now, these data from that portion of the great agricultural region which borders upon the arid plains with the average for our district, as already stated, and it will be seen that we have there an annual rainfall equal to but little more than half the minimum amount that in the region to the eastward is regarded as necessary to raise a crop. It is plain, therefore, that far the greater part of the water which flows in the rivers of our district, falls upon the adjacent mountains, and reaches those rivers of the plains by their mountain tributaries.

But this mountain rainfall, although it is copious, as compared with that of the plains, is not very great. If we take the mean annual rainfall as given in the preceding table for Pike's Peak as the average for all the mountain district within which that peak is located, and which is drained upon our district, and average it with the assumed mean annual rainfall there, we find a mean annual rainfall for our district, together with the adjacent mountains, of 21.774 inches. This is less than the minimum amount which, according to the foregoing estimate, is necessary for the successful growth of a farm crop, if it were uniformly distributed over mountain and plain. This low average is probably higher than actually occurs, because the rainfall upon the higher peaks of the mountains, like Pike's Peak, is greater than upon the lower mountains and the foot-hills, which are included in the above estimate.

It will be seen from these data how small an amount of water falls upon our district, and its dryness in summer will be still more apparent when it is remembered that direct rainfall, away from the larger rivers, is its only natural source of water supply. The bearing of these facts upon the question of successful artesian wells for the district will be discussed on following pages.

ARTESIAN BORINGS HITHERTO MADE WITHIN AND NEAR THE DISTRICT.

A few attempts have been made within and near our district to secure supplies of water by means of artesian borings. All except one of these have been made by private parties or corporations, the exception being the boring that has been made at Fort Lyon, Colo., under the auspices of the Agricultural Department. We have already made a special report upon this boring, which accompanies this report in the form of an appendix.

The most notable of the borings which have been made by private parties are two, both of which are located at Pueblo, Colo. From of all the other formations together; in consequence of which, and of its lithological characteristics as already described, it has a very important bearing upon the questions to be discussed in this report. The area occupied by the Laramie Group is shown by the spaces upon the accompanying geological map which are colored by green, circular dots on a yellow ground and marked by the letter L. Although the flexed condition of the strata of this group, in the immediate vicinity of the mountains, shows that they were all originally upturned to an equal extent with the others which underlie them, they are now not often found to enter into the structure of the foot-hills proper. This is without doubt due to the fact that the Laramie strata, being as a rule comparatively soft and friable, have been removed by erosion wherever they have been prominently exposed by reason of the upward flexure, while the harder strata of the formations beneath them remain in the form of the prominent hog-backs among the foot-hills that have already been described.

Cretaceous formations.—The strata of marine origin which are referable to the Cretaceous period are in Colorado divisible into only three distinct groups,* namely, the Fox Hills or Upper, the Colorado or Middle, and the Dakota or Lower. All three of these groups are flexed up together against the mountains, and all three of them enter to some extent into the structure of the foot-hills. Upon the plains the Cretaceous strata, like all the others, being in nearly a horizontal position, do not produce any prominent features in the landscape.

Next to the Laramie Group, the strata of these three Cretaceous groups occupy a greater portion of the surface of the district than any other. Upon the plains they are exposed in the valleys and vicinity of the rivers and their larger tributaries; and the areas which they occupy are represented by the spaces on the accompanying geological map, which are colored green and marked by the letters Cr.

The lithological characteristics of these three groups, as well as those of the others yet to be noticed, have an important bearing upon the question of artesian water supply.

The Fox Hills Group is composed in large part of bluish clayey strata, somewhat arenaceous for the upper portion, and sandstones and sandy shales for the lower portion; but among the latter are many soft and some clayey layers.

The Colorado Group is composed very largely of argillaceous shales, and toward the base these shales are somewhat firm and calcareous, and often fissile. This description applies more particularly to the northern portion of the district, but in the southern portion this group is much more calcareous than in the northern, and near its upper portion there are many layers of firm, regularly-bedded, gray limestone. As a whole, the Colorado Group is one that will evidently not allow the free percolation of water through it. Indeed, it is evident that this group would present great obstruction to the percolation of water.

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* See Annual Report U. S. Geol. Sur. Terr. for 1876, p. 29.

The Dakota Group is largely made up of coarse, rough layers of more or less firm sandstone, and although a considerable portion of it is soft, and sometimes clayey, it is perhaps more pervious to water than any of the other formations which underlie the district. These sandstones are therefore regarded as presumably water-bearing strata. It is one of the most uniform in its lithological characteristics of all the Cretaceous groups of North America.

Jurassic.—This is one of the thinner of the formations which underlie our district, averaging only 500 feet at its western border, where the formation is upturned among the foot-hills. It is composed mainly of argillaceous material, in the form of clayey and somewhat sandy shales, with occasional beds of impure limestone and sometimes small deposits of gypsum. As a whole, therefore, this formation is also one of the most impervious to water. Although it is evident that these Jurassic strata underlie at least all the western portion of our district, none of them are exposed at the surface within its limits, but the whole formation is upturned among the foot hills, where, being composed of easily eroded material, it usually occupies the longitudinal valleys which are bordered on either hand by the hog-backs of the Dakota and Triassic groups respectively.

The limited area within which the strata of this group are exposed at the surface is too small to be represented alone, and it is therefore included in the very narrow, irregular, interrupted purple stripe upon the accompanying geological map, marked by the letters J. T., which also includes the Triassic strata.

Triassic.—Although—as is shown by the narrow space upon the map which has just been mentioned—this formation occupies a very narrow area of the surface, it is the thickest, and in some respects one of the most important of the formations which we have occasion to discuss. It has an average thickness of about 1,700 feet. It is composed mainly of sandstones, which are often coarse, and which sometimes alternate with layers of conglomerate. The nearly uniform red color that prevails throughout the formation almost everywhere has caused the common name of "Red Beds" to be applied to it. The sandstone layers are usually harder than those of the other formations, but still they are not very dense, and those alternate with softer layers, some of which are argillaceous. The greater part of the strata of this formation being harder than those of the other formations that have been described, they often form large and conspicuous hills among the foot-hills, many of which are in the form of huge hog-backs.

Like the Jurassic, none of the strata of the Triassic formation are exposed upon the plains, and therefore not within the limits of our district, and the foregoing description has been drawn wholly from the strata as they are seen among the foot-hills. That the formation really does extend far out from the mountains under the plains is, in our opinion, not to be questioned, and that the strata have the same general characteristics there may be legitimately inferred from the fact that those characteristics are very uniform wherever the formation is found at the surface on both sides of the Rocky Mountains. These inferences are also confirmed by the result of the boring that has been made near Fort Lyon.

This formation, composed as it is of sandy rock, would, if its strata were loosely compacted and regularly bedded, no doubt allow the ready percolation of water; but many of the strata are often found to be very dense, and many are also so argillaceous as to render it unlikely that much water could percolate through them. But the formation is a very thick one, and many of the strata would doubtless be permeable wherever a water supply may exist in contact with them. Therefore we shall regard it as like the Dakota sandstone—a presumably water-bearing formation.

The formations that we have here described constitute the whole series of stratified rocks that are known to underlie the district. The small local deposits of Silurian and Carboniferous strata, which are in a few places found among the foot-hills and the adjacent mountains, suggest that the same formations exist, to some extent at least, beneath the surface of our district, and consequently beneath the Triassic rocks. Possibly the last-named strata may there, at least in part, rest directly upon the archæan rocks, as they are seen to do in most cases at the foot-hills; but in any case the archæan rocks doubtless lie at a depth beneath the plains that will be beyond the reach of any borings that it will be found expedient to make there.

The only method by which the actual presence beneath the surface of the plains of any series of rocks older or lower than the Cretaceous can be demonstrated is by artesian borings. We may, however, to some extent, draw inferences as to the probable presence or absence of certain formations, respectively, beneath given portions of the district. For example, it is probable that beneath its eastern portion the Silurian and Carboniferous rocks are present and more fully developed there than they are at the foot of the mountains, because those rocks, as well as those of Devonian age, are well developed in the valleys of the Mississippi and Lower Missouri Rivers. Again, the Jurassic and Triassic strata, especially the latter, are, as has already been shown, well developed along the western border of the district; but neither of these formations are known to exist in the Mississippi and Lower Missouri Valleys, nor at any point between them and the eastern base of the Rocky Mountains. Therefore the inference is plainly correct that those formations have thinned out somewhere beneath the plains, and it is possible that they may have done so before they reached the eastern border of the district. It is also probable, or even practically certain, that the Cretaceous strata, except the Dakota Group, also materially diminish in thickness as they extend to the eastward. The same is evidently true of the Laramie Group, which doubtless thins out entirely in Western Kansas and Nebraska.

If, therefore, we should make a boring upon the plains within a short distance eastward from the Rocky Mountains we should expect, from our knowledge of the character and order of the strata as we find them flexed up against the mountains, that the drill would pass through the same formations and in the same order. The boring that has been made at Fort Lyon, Colo., under the auspices of the Agricultural Department, has really proved that this condition of things exists beneath the plains, 100 miles eastward from the mountains.

It is unfortunate, however, speaking from a geologist's stand-point, that the boring there was not carried down until the Triassic rocks were passed, instead of stopping, as it did, in those strata. This act, however, was plainly justified from an economic stand-point, as we have shown in our special report upon the subject.

If we were to make a boring upon the plains near the eastern border of our district, which is some 150 miles eastward from the base of the mountains, we might, from our knowledge of the broad, geographical extent of those formations, reasonably expect to find all the formations present there, from the Laramie to the Dakota Group, inclusive; and perhaps also the Jurassic and Triassic. It may be, however, that the two latter formations have entirely thinned out before reaching so far eastward; and it is quite certain that all the others, except the Dakota Group, which is known to exist in full force in Kansas and Nebraska, would be found to have become much thinner than they are at the base of the mountains. The question of the thinning or thickening to the eastward or westward of the formations that underlie the plains is a matter of practical importance, as well as of geological interest, as will be seen by our remarks under the head of conclusions. In this connection it should be stated that we have good reasons for believing that as a whole the stratified rocks which underlie the plains are much thinner at the eastern than at the western border of our district.

The unstratified archæan rocks of the Rocky Mountain region, and which it is assumed deeply underlie our whole district, appear at the surface within those areas which on the accompanying geological map are colored with a pink tint, and are marked with the letter M. They are such as are often designated as metamorphic rocks, and are similar in character to those which underlie the lowest stratified rocks elsewhere, so far as that character relates to the question of artesian water supply. That is, not being stratified, we cannot calculate upon the course that water will take in passing through them, nor, indeed, can we think it probable that water will find its way by percolation through them beneath the surface to any considerable horizontal distance from the place where it falls from the clouds. It is true that springs are more or less frequently met with among that portion of the Rocky Mountains which lies adjacent to our district, issuing from the archæan rocks, and water is also frequently so abundant in the deeper mines of those mountains as to greatly impede the working of them.

This water is without doubt, in every case, derived from the rains and snows that fall upon the mountains in the immediate vicinity of the springs and mines referred to, and it has made its way to these outlets through the numerous irregular fissures which prevail in such rocks. These fissures, being irregular in character and direction and the rocky masses through which they pass being without stratification, the courses which those fissures may take cannot be calculated. Their irregular character, and the well-known character of the kind of rock through which they pass, renders it certain that however numerous these fissures may be they do not form continuous channels for the conduction of water to any considerable horizontal distance beneath the surface. While it is probable that water may percolate through the great mass of the unstratified rocks of the Rocky Mountains, and that some water may find its way thus and by means of fissures beneath the stratified rocks upon the plains in the immediate vicinity of the mountains, it is not to be expected that even small quantities of water should be thus conveyed beneath the plains to any considerable distance from its mountain sources. Practically, then, we think we are justified in regarding the unstratified archæan rocks as forming an impervious base to the stratified series of rocks within which, if anywhere, we may hope to obtain a water supply upon the plains by means of artesian borings.

We have already referred to the gentle general dip to the eastward from the base of the mountains of all the formations of stratified rocks which underlie our district. Although neither this easterly general dip nor the modifications of it which exist in various parts of the district are discernible to the eye, our acquaintance with the lithological and paleontological characteristics of the strata which are exposed at different points on the plains throughout the district, taken in connection with several series of elevations above the level of the sea that have been referred to has enabled us to reach conclusions that would not have been otherwise attainable. A portion of those series of elevations we have obtained from Gannett's published lists, and others have been furnished to us by the officers of the Union Pacific and Burlington and Missouri River Railroad Companies respectively.

The modification of the general eastwardly dip of the strata of the district which has been referred to consists of gentle undulations of the strata, which are so very broad and slight that they could not be detected, except by means of the railroad levelings that have been referred to and the surface slopes of the Arkansas and South Platte rivers. We have used the surface slopes of these rivers as base-levels by which to note the rise and dip of certain recognizable and persistent strata, above and below those levels, in the banks of the Rivers respectively. By means of these methods of observations we have ascertained that the Arkansas and South Platte Rivers each runs upon a very gentle anticlinal axis of the underlying strata, which axis extends across nearly or quite the whole breadth of the district. Consequently, there is a very gentle and very broad synclinal axis between the two rivers. The distance between the two rivers at the eastern portion of our district is about 180 miles, and the extent to which the strata are flexed downward between them there is estimated at about 400 feet.

The gentle undulations along north and south lines which the strata of the plains are found to possess, and which lie at right angles with the broad east and west anticlinals and synclinals that have been mentioned, have been explained in our special report upon the boring which has been made near Fort Lyon, Colo., under the auspices of the Department of Agriculture, and which is added to this report in the form of an appendix. No such undulations have been observed along the valley of the South Platte, and although they may exist elsewhere in the district than in the valley of the Arkansas River their presence has not been detected. Those undulations, as shown in the report referred to, have an important bearing upon the question of artesian water supply in the region of that valley. It will also be seen in the sequel that the broad synclinal between the two rivers of the plain, which has been explained, although so slight in the amount of its depression, is a very important geological feature in relation to the subject of this report.

The superficial deposits of the plains.—Before closing these remarks upon the geology of the district, further mention should be made of the superficial deposits or *débris* of the plains. This material, as already stated, is derived mainly from the immediately underlying stratified rocks, by their disintegration; but scattered among it, even as far out from the mountains as the eastern border of our district, are small fragments of granitic rock, which by its character is plainly seen to have been derived from the archæan rocks of the mountains. It was probably transported thence by the action of ice during the glacial epoch. This fine angular gravel sometimes, but seldom, is found in perceptible local accumulations upon the higher surfaces of the plains, but it is more perceptible in the valleys. Indeed, the larger valley bottoms are apparently all underlaid by material which consists largely of this loose drift-gravel. This condition of the ground makes the procuring of ordinary wells of good water at moderate depth in the larger valley bottoms of the district an easy matter in almost all cases.

PRIMARY SOURCES OF WATER SUPPLY.

In such districts as lie below the level of great lakes or other bodies of water that may exist in their vicinity, it is possible that an artesian water supply may be derived from such a source. In the region within which our district is located, however, no such source of supply can be considered, because no such bodies of water exist there nor in the regions round about, and no rivers traverse the district other than those

which have their rise in the adjacent mountains. Therefore, the only primary source of water supply to be considered in this report is that of rainfall.

For the purpose of showing the amount of water that falls upon the surface in and around our district, the following tables of rainfall are given, which have been compiled from the published reports of the United States Signal Office, the publications of the Smithsonian Institution, and Powell's Report on the Lands of the Arid Region of the United States. So few stations of observation have been located upon the more arid portions of the great plains that these tables do not really show the full extent of the contrast between those portions and the more favored region immediately to the eastward as regards the amount of rainfall, but these data are the most instructive of any that we have found available for our present purposes.

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Localities.	1874.						1875.						
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Pike's Peak	6.00	3.72	2.31	1.80	0.36	0.22	0.76	0.50	1.03	0.92	2.08	1.70	21.40
Denver	3.25	0.68	1.34	0.64	0.18	0.17	3.38	0.60	0.39	2.24	1.94	0.43	15.24
Cheyenne	1.87	0.44	0.93	1.86	0.04	0.16	0.42	0.06	0.23	0.50	1.20	0.29	8.00
* North Platte	2.48	2.42	0.85	1.46	0.57	0.34	0.24	0.26	0.40	6.21	1.69	1.62	21.24
* Dodge City	2.28	2.92	0.94	0.22	0.23	0.05	0.12	0.10	0.04	0.72	2.26	0.73	11.61
Omaha	0.54	2.08	7.18	1.45	1.05	0.54	0.26	0.51	1.24	3.06	4.25	10.95	33.11
Leavenworth	3.23	1.72	5.50	1.49	3.46	1.35	0.23	1.25	2.50	1.67	3.53	3.85	29.78
	1875.						1876.						
Pike's Peak	8.18	3.52	3.20	0.38	1.54	0.98	0.85	0.61	2.03	1.04	4.73	2.88	29.89
Denver	4.32	1.97	2.89	0.22	1.28	0.59	0.21	0.11	1.80	1.22	8.57	1.10	24.28
Cheyenne	4.47	2.12	1.34	0.60	0.84	0.03	0.02	0.06	0.54	0.23	2.50	0.10	12.85
North Platte	2.12	0.66	1.40	0.14	0.52	0.09	0.09	0.13	0.49	0.51	2.97	0.49	9.61
Dodge City	3.28	2.06	1.32	0.06	0.00	0.09	0.00	0.05	3.59	0.16	1.15	1.53?	14.29
Omaha	10.01	7.77	2.55	1.16	0.13	1.00	0.22	0.40	3.18	2.65	2.07	3.47	34.61
Leavenworth	8.82	3.73	1.97	0.72	0.39	2.60	1.42	0.20	5.78	7.65	6.78	5.71	45.77
	1876.						1877.						
Pike's Peak	2.20	4.63	1.60	1.45	1.06	0.79	1.49	1.29	1.53	2.91	2.82	3.36	25.13
Denver	1.16	2.03	0.60	0.12	1.50	1.70	1.90	0.40	1.40	2.77	2.30	1.93	17.81
Cheyenne	0.79	0.26	0.00	0.00	0.32	0.21	0.20	0.14	0.98	1.11	2.24	1.27	7.51
North Platte	1.16	2.46	1.47	1.07	0.49	0.51	1.38	0.37	0.19	0.37	3.22	2.99	15.66
Dodge City	2.26	1.03	2.13	1.00	1.35	0.15	0.18	0.56	0.25	3.38	4.96	3.92	21.17
Omaha	7.30	6.27	4.93	0.69	1.17	0.16	0.53	0.44	1.26	6.24	8.62	8.36	45.97
Leavenworth	4.01	3.40	3.56	2.79	2.87	0.31	0.73	0.50	4.39	7.14	8.67	10.00	48.37
	1877.						1878.						
Pike's Peak	2.70	2.10	2.69	3.74	0.54	0.41	0.29	1.45	2.95	3.77	4.32	3.49	28.45
Denver	0.33	1.30	0.38	2.15	0.73	0.79	0.10	0.48	1.82	0.05	2.90	2.78	13.81
Cheyenne	0.43	0.83	2.02	1.99	0.17	0.33	0.08	0.13	1.16	0.19	4.46	1.71	13.50
North Platte	2.04	5.03	4.49	1.23	0.30	3.86	0.00	0.18	1.40	1.15	3.24	5.85	28.77
Dodge City	1.79	4.09	0.50	3.34	0.56	4.36	0.21	1.13	1.01	1.06	4.63	2.19	24.87
Omaha	0.96	3.13	2.05	5.86	1.36	2.14	1.13	0.14	3.09	3.97	5.77	8.48	38.08
Leavenworth	5.34	2.85	1.95	4.87	2.44	3.18	2.34	2.94	2.85	2.86	5.28	5.27	41.67

TABLE No. 1.—*Annual and monthly rainfall at certain points in Colorado, &c.*—Continued.

Localities.	1878.						1879.						
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Pike's Peak	5.46	6.12	2.42	0.24	7.81	4.55	3.71	2.66	2.20	12.15	3.26	0.68	51.26
Denver	1.38	2.25	1.23	0.80	0.67	1.05	0.40	0.39	1.00	2.62	3.36	0.32	15.47
Cheyenne	1.43	2.50	0.75	0.04	0.00	0.19	0.32	0.20	0.44	1.66	1.30	0.07	8.90
North Platte	3.58	1.52	0.91	0.13	0.46	0.20	2.33	0.43	0.11	1.92	2.25	3.31	17.15
Dodge City	1.61	4.48	0.76	0.09	0.60	0.19	0.87	0.08	0.17	0.40	0.90	4.40	14.55
Omaha	7.66	2.48	3.22	0.55	0.29	0.27	0.07	0.93	2.17	1.77	5.53	4.09	29.03
Leavenworth	3.08	3.31	2.64	1.16	1.76	2.16	1.16	0.54	0.32	0.42	3.04	9.90	29.49

*The rainfall for July and August, 1874, was not recorded, and those entries in this table have been supplied by taking the mean of the rainfall for those two months in the other four years.

Mean annual rainfall for the five years ending June 30, 1879.

	Longitude.	Rainfall.
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Denver, Colo	105 00	15.322
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Fort Lyon, Colo	102 50	12.560
Cheyenne, Wyo	104 49	10.154
North Platte, Nebr	100 46	18.490
Dodge City, Kans	100 00	17.298
Omaha, Nebr	95 56	36.160
Leavenworth, Kans	94 52	39.018

TABLE No. 2.—*Totals of annual rainfall at Sidney Barracks, Fort McPherson, and Fort Kearney, Nebraska.*

SIDNEY BARRACKS.

Longitude 102° 58′.

	Inches.
1873	12.38
1874	14.77
Mean	13.58

FORT MCPHERSON.

Longitude 100° 30′.

	Inches.
1868	29.01
1869	10.08
1870	18.62
1871	20.04
1872	16.07
1873	18.86
1874	17.16
Mean	18.55

FORT KEARNEY.

Longitude 98° 57′.

	Inches
1849	45.76
1850	25.07
1851	26.44
1852	20.65
1853	29.90
1854	26.65
1855	25.05
1856	29.10
1857	28.62
1858	26.14
1859	16.10
1860	16.85
1861	19.34
1862	22.10
Mean*	25.55

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*It will be seen that the data given for Fort Kearney, which are copied from the Smithsonian reports, end with the year 1862. It is claimed by some persons conversant with the facts, that there has been a material increase in the annual rainfall since that time, but we have not the data at hand which will indicate whether such an increase, if it really has occurred, is likely to be permanent.

which have their rise in the adjacent mountains. Therefore, the only primary source of water supply to be considered in this report is that of rainfall.

For the purpose of showing the amount of water that falls upon the surface in and around our district, the following tables of rainfall are given, which have been compiled from the published reports of the United States Signal Office, the publications of the Smithsonian Institution, and Powell's Report on the Lands of the Arid Region of the United States. So few stations of observation have been located upon the more arid portions of the great plains that these tables do not really show the full extent of the contrast between those portions and the more favored region immediately to the eastward as regards the amount of rainfall, but these data are the most instructive of any that we have found available for our present purposes.

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Denver	3.25	0.68	1.34	0.64	0.18	0.17	3.38	0.60	0.39	2.24	1.94	0.43	15.24
Cheyenne	1.87	0.44	0.93	1.86	0.04	0.16	0.42	0.06	0.23	0.50	1.20	0.29	8.00
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* Dodge City	2.28	2.92	0.94	0.22	0.23	0.05	0.12	0.10	0.04	0.72	2.26	0.73	11.61
Omaha	0.54	2.08	7.18	1.45	1.05	0.54	0.26	0.51	1.24	3.06	4.25	10.95	33.11
Leavenworth	3.23	1.72	5.50	1.49	3.46	1.35	0.23	1.25	2.50	1.67	3.53	3.85	29.78
	1875.						1876.						
Pike's Peak	8.13	3.52	3.20	0.38	1.54	0.98	0.85	0.61	2.03	1.04	4.73	2.88	29.89
Denver	4.32	1.97	2.89	0.22	1.28	0.59	0.21	0.11	1.80	1.22	8.57	1.10	24.28
Cheyenne	4.47	2.12	1.34	0.60	0.84	0.03	0.02	0.06	0.54	0.23	2.50	0.10	12.85
North Platte	2.12	0.66	1.40	0.14	0.52	0.09	0.09	0.13	0.49	0.51	2.97	0.49	9.61
Dodge City	3.28	2.06	1.32	0.06	0.00	0.09	0.00	0.05	3.59	0.16	1.15	1.53?	14.29
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North Platte	1.16	2.46	1.47	1.07	0.49	0.51	1.38	0.37	0.19	0.37	3.22	2.99	15.68
Dodge City	2.26	1.03	2.13	1.00	1.35	0.15	0.18	0.56	0.25	3.38	4.96	3.92	21.17
Omaha	7.30	6.27	4.93	0.69	1.17	0.16	0.53	0.44	1.26	6.24	8.62	8.36	45.97
Leavenworth	4.01	3.40	3.56	2.79	2.87	0.31	0.73	0.50	4.39	7.14	8.67	10.00	48.37
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1849	45.76
1850	25.07
1851	26.44
1852	20.65
1853	29.90
1854	26.65
1855	25.05
1856	29.10
1857	28.62
1858	26.14
1859	16.10
1860	16.85
1861	19.34
1862	22.10
Mean*	25.55

*It will be seen that the data given for Fort Kearney, which are copied from the Smithsonian reports, end with the year 1862. It is claimed by some persons conversant with the facts, that there has been a material increase in the annual rainfall since that time, but we have not the data at hand which will indicate whether such an increase, if it really has occurred, is likely to be permanent.

After a somewhat careful investigation of the geology of that vicinity, we have reached the conclusion that even if the whole series of stratified rocks there should be pierced by the drill (which, in our opinion, would be within 1,000 feet beneath the bottom of the boring at the time of our visit), it is not probable that a plentiful supply of water will be obtained there. In the following remarks we endeavor to explain our reasons for arriving at this conclusion.

In our final report* we shall discuss the dips of the strata within the region which embraces the locality of the well in question, together with their lithological characteristics, as those questions are found to bear upon the probabilities, or otherwise, of obtaining water by means of artesian borings. Anticipating briefly a portion of this discussion, we may state that while pursuing our investigations in the valley of the Arkansas River, in which valley the boring in question is situated, we ascertained to our satisfaction that from a point a short distance east of the town of Pueblo to the eastern boundary of the State that river runs upon a gentle anticlinal axis; that is, while the surface of the region adjacent to the river valley slopes toward the river upon both sides of it, the strata which underlie the surface dip away from the river, both northward and southward.

There is also a general eastwardly dip of the same strata, which we ascertained to coincide almost exactly with the slope of the stream; that is, there are very gentle and broad undulations of those strata, which are ascertained to exist by means of certain readily recognizable persistent layers, of one of the formations which underlie the surface there. These layers are at some places seen to rise a little above the level of the stream, as they are exposed in its banks, and at other places to pass a little beneath it.

Now, we find that the artesian boring near Fort Lyon has been located upon one of those gentle elevations of the strata, which has brought to view in the banks of the river there the layers referred to. A short distance above Fort Lyon these layers are seen to pass beneath the level of the river, and they also pass beneath that level a few miles below that place.

In accordance with these facts and determinations, it is plain that there is a slight dip of the strata in all directions away from the neighborhood in which the boring near Fort Lyon is located, of which dips the whole series of stratified rocks, the deeper as well as those which are visible at the surface, which underlie that locality unquestionably partake.

Applying the well-known theory of artesian wells to the condition of the strata that exists in the neighborhood of Fort Lyon, as we have explained, an unfavorable result may be reasonably expected from the boring now being prosecuted there. If that region were humid instead of arid, and the earth there were saturated with wate as it is in humid regions, it is believed that the unfavorable dips of the strata whic have been referred to are so slight that a fair supply of water might possibly ris to the surface in the boring near Fort Lyon by means of the general favorable di to the eastward which those strata are known to have in that region. But knowin such a condition of the strata to exist in a locality, we do not think any one would b justified in beginning an artesian boring there, even under the most favorable conditions of climate as to rainfall and moisture.

We ascertained that the boring near Fort Lyon had been begun upon the Colorad or middle group of the Cretaceous series and near its base, the valley being the excavated out of the upper portion of the group. The drill had passed through th remainder of this group; then through the Dakota or lower group of the Cretaceou series; then through the Jurassic series and into the Triassic.

In consequence of the destruction or disarrangement of a large portion of the cor which had been brought out of the boring by means of the diamond drill before ou arrival, we were not able to study fully the fine geological section of the strata whic underlie the surface there, and which that core would have presented if it had bee carefully preserved. By examination of the portions of the core that were preserved in connection with the statements that were made to us by the superintendent i charge of the work, we have assigned to each group of strata that was passed throug by the drill the thickness in feet which is expressed by the following figures:

	Fee
Colorado Group, Cretaceous	1
Dakota Group, Cretaceous	3
Jurassic	2
Triassic	
Total	6

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*Now published in the foregoing pages. This special report was submitted befo the final one was written.

The drill had passed into the Triassic series of strata only about 28 feet, and it is known that much more of that series yet remains to be pierced. The foregoing measurements indicate that the several groups of strata which have been passed through by the drill are considerably thinner there than they are where they are upturned against the base of the Rocky Mountains, about 100 miles to the westward. This fact indicates that all the groups of strata beneath that and adjacent portions of the great plains will be found to become thinner to the eastward from the mountains, and that, therefore, the whole series of stratified rocks which exist there may be pierced by a boring at a much less depth at a considerable distance out upon the plains than they would be near the mountains, where the aggregate thickness of those strata is known to be very great. We infer from this also that the Triassic series of strata, in which the drill is now working at the boring near Fort Lyon, is there probably not more than 1,000 feet thick, and that it may be less; but we have yet no positive data upon this point.

At the base of the mountains the Triassic strata generally rest directly upon the archæan or unstratified rocks, and perhaps the two series hold the same relation to each other beneath the neighborhood of Fort Lyon; but it is not improbable that the Carboniferous and Silurian strata may intervene between them there. We think it is barely possible that water may rise to the surface in the boring in question when the base of the Triassic series of strata is reached by the drill, but for the reasons already explained we should not expect it. We are clearly of the opinion that in any case it will be useless to continue that boring into the unstratified rocks or to any depth beneath the base of the Triassic series.

Since you have expressed a wish that we should be explicit in the expression of our views on this subject, we will say that we believe the selection of the site of the artesian boring near Fort Lyon to have been an unfortunate one. We may add that, believing the conditions of the strata which underlie the surface at that locality to be unfavorable to success in obtaining a satisfactory flow of water from the boring now in progress there, a permanent discontinuance of the work at any time would be justifiable. As geologists, however, we would much prefer to have the work continued and the core of the drill carefully preserved until the archæan rocks are reached. We beg also to improve this and every opportunity to recommend the use of the core-drill in all future borings that may be made under your direction, because such borings will give us a knowledge of the geological structure beneath the surface of the great plains that can be obtained in no other way.

We have constantly declined any communication or correspondence with any and all persons interested in well-boring machinery of any kind, and we make the above recommendation wholly in the interest of geological science.

Very respectfully submitted.

C. A. WHITE,
SAMUEL AUGHEY,
Commissioners.

WASHINGTON, D. C., *October* 20, 1881.

APPENDIX III.

REPORT OF HON. HORACE BEACH.

Mr. Beach, having been added to the commission for the purpose of collecting statistics in relation to the practical work of boring artesian wells in the region under investigation, makes the following report:

Hon. GEORGE B. LORING,
Commissioner of Agriculture:

SIR: I have the honor to submit herewith the following summary of facts which I have obtained, in accordance with instructions from your department, and subsequent special instructions from Dr. C. A. White, chief of the commission on artesian wells.

In compliance with the special instructions embodied in my commission, I went to Fort Lyon, Colorado, to make an examination of an artesian boring near that place, located and commenced by your predecessor in office. I made a thorough investigation of the work done and of the prospect for obtaining water at that point, and reported promptly to the department. I found the well located about 6 miles from West Las Animas, and about 2 miles from Fort Lyon, in the valley of Arkansas River. The work was apparently being pushed forward as fast as the kind of drill used would permit. The depth of the bore at that time was 600 feet. A small flow of good water was obtained at a depth of 450 feet, which I estimated at about one and a half gallons per hour, the hydrostatic pressure of which was found to be sufficient to raise the water 10 feet above the surface of the ground. The indications were thought favorable for obtaining a good flow from a boring of sufficient depth.

Inasmuch as large expense had been incurred by the government in putting the machinery in place, and the superintendent in charge of the work gave assurance that he could bore 15 feet each day of twelve hours, taking into account also the fact that the work was experimental, I recommended to the department that the work should be prosecuted until a depth was reached of at least 1,500 feet, if water should not be obtained in sufficient quantity before reaching that depth. Had the work progressed as Mr. Douglass expected, the depth of 1,500 feet would have been reached in sixty days. I have learned recently, however, that little progress in the work has been made since my visit there.

I think the location selected for trying the experiment an undesirable one. Being within 2 miles of the Arkansas River, its utility would have been lessened had water been obtained by the fact that herds could easily procure water at the river. Yet a large tract of land might be irrigated from the well, could sufficient water be obtained.

The water to supply the engine and drill was hauled a distance of 2 miles, on wagons, at an expense of $4 per day and $3.50 for teams. It would have been more economical to put down a small pipe-line to the river and force the water up to the engine with a pump. I am also of the opinion that the work could have been more economically performed by contract at so much per foot than by the plan adopted, as will be presently shown, besides relieving the department of annoying details in the prosecution of the work.

The kind of drill used in this work is what is called the diamond drill, a tool poorly adapted to the purpose. On a following page I discuss the comparative economy and adaptability of the different kinds of tools used for boring wells.

I am still of the opinion that flowing water may be obtained at this locality if the bore is carried deep enough.

After examining the well at Fort Lyon, I reported in person, on the 24th of August, to Dr. C. A. White, at Pueblo, Colo., and received from him instructions as to subsequent investigations, the results of which are embodied in the following pages. An important portion of this work was the procuring of data concerning the borings that have been made by private parties in and near the region which the commission was appointed to examine. In prosecuting these inquiries I found some difficulty in ascertaining the localities where borings had been attempted, inasmuch as I had no previous information upon the subject. It became necessary to get information of persons who happened to be in possession of the necessary facts, and in some instances I have been obliged to repeat my journeys because of information subsequently obtained. I have obtained knowledge concerning several borings that have been made in several parts of the district, embracing portions of Colorado, New Mexico, and Wyoming. In a part of these cases no reliable record of borings had been made, and in some cases if a record had been made it seems to have been subsequently lost. In the latter cases I was obliged to rely upon the statements of those who professed to have a recollection of the facts, but these statements are regarded as only approximately correct. Usually, upon visiting the sites of the borings, but little could be found to indicate the nature of the strata that had been pierced.

THE BORING AT SOUTH PUEBLO, COLO.

At South Pueblo, in the valley of Arkansas River, and only a few feet above the level of the river, a well was bored in 1879 for petroleum by the Pioneer Oil Well Company. To Mr. Silas Clarke, superintendent of the work, I am indebted for the following statement concerning this boring:

The work was performed with a 15 horse-power engine, walking-beam and churn drill, worked with a 1¼-inch rope, similar to those used in the oil regions of Pennsylvania. This well was cased to the depth of 392 feet with a 6-inch casing. Below this the rock was sufficiently solid to sustain itself.

At a depth of 1,180 feet a flow of water of a mineral character and 82° Fahr. was obtained, which discharged 160,000 gallons every 24 hours. The boring was continued beyond this to a depth of 1,400 feet. The entire cost, including engine, drilling-tools, labor, coal, &c., was $7,222. Not including the engine and drilling-tools, but including all other expenses, the cost was $5,222, equal to $3.73 per foot. Including the engine, tools, coal, water, and labor, and all other expenses, the cost would be about $5.16 per foot.

THE BORING AT DENVER, COLO.

A boring was made in 1871, about 1½ miles eastward from Denver, on an elevation called Capitol Hill. No record of this boring could be obtained, and a visit to the site did not afford much information. The following approximate statement, however, was obtained from Mr. Byers, postmaster of Denver, who took much interest in the subject. At 670 feet from the surface water was struck, which flowed to the surface, but soon became obstructed, and the work was discontinued. The strata passed through in this boring were sandstone, shales, and joint-clay. The first water was reached at a depth of 290 feet, and the second at 440 feet from the surface.

THE BORING AT SERVILLETA, N. MEX.

The Denver and Rio Grande Railway Extension Company has made a boring at Servilleta. I visited this place, and found that the boring had been carried to a depth of 650 feet. The first 20 feet were through clay; next 195 feet of porous lava rock; then 35 feet of hard sandstone; then 50 feet of coarse red sandstone; then 350 feet of fine yellow and white sand, very soft and friable, so much so as to fall in and necessitate the insertion of an inner casing through the first, which was 6 inches in diameter, and inserted to the depth of 160 feet. In attempting to insert the inner casing it was telescoped and the work finally abandoned without obtaining water.

The water to supply the engine and drill was brought from a distance on water cars. The cost of this boring was $5 per foot, the contractor furnishing all the machinery and tools and paying for the labor. The railroad company furnished coal and water. The drill used was the walking-beam churn drill, worked with a rope, like those used in the Pennsylvania oil regions.

THE BORING AT COAL CREEK, COLORADO.

In the year 1880 a well was bored at Coal Creek, Fremont County, Colorado, by the Grand Cañon Coal Company, then prospecting for coal. From Mr. J. W. Rathburn, who drilled the well, I learned that it was bored to a depth of 1,278 feet. At 350 feet a small flow of water was obtained, amounting to about 3½ gallons per hour. This water rose 335 feet. Forty-five feet from the bottom a small amount of petroleum was obtained. The diameter of the bore was 4¼ inches, and the drilling was performed by a walking-beam and rope, and club bit with jars.

BORINGS NEAR GREELEY, COLO.

From Messrs. Emerson & West, bankers, Greeley, Colo., I learned that several borings had been made in that vicinity by the Prospecting Coal Company of Greeley. According to this information, the depths reached only 48 feet, and of another, 100 feet Water was reached in both cases.

About 8 miles from Greeley, in Lone Tree Valley, a hole was dug to the depth of 35 feet in prospecting for coal. At that depth a vein of water was struck which flowed in rapidly, filling the hole to within 18 feet of the surface. These borings were made for $1.20 per foot. The work was done by a churn drill and spring-pole.

Mr. West also gave me the following data from memory (he having mislaid his notes of the work) of a boring he had made near Greeley: "The bore was 3½ inches in diameter; depth, 200 feet; first soil, 22 feet of sandy loam, with a stratum of calcareous matter, which I have analyzed, showing sand and calcareous matter in about equal proportions. The rest of the distance was through sand-rock, hard and soft, and shales. My recollection is that it was about 10 feet of soft sand-rock; then 1 to 1½ feet of very hard sand-rock; then shale, sometimes decomposed; then soft sandstone and hard sandstone alternately all the way down, except that in one instance, instead of shale, there were 6 inches of coal. Water was struck at 75 feet, but only a small quantity, which rose only a little above the point where it was struck. I had very rough machinery, only a spring-pole to raise the drill, and the work was consequently expensive, the cost being $3 per foot."

THE SECOND BORING AT PUEBLO, COLO.

Mr. J. W. Rathburn, from whom I obtained the data concerning the boring at Servilleta, has furnished me with the data of a second boring at Pueblo, which he has since made there for the South Pueblo steel works: "The boring is now down 1,200 feet, and we have a flowing well of warm water, nearly pure. The drill passed through loose material 28 feet; slate to 685 feet; 60 feet of white limerock; slate and shales to 1,070 feet; a bed of chalky substance, probably 20 feet; then slate and shale and brittle rock, with alternate veins of water, to about 1,200 feet. The cost will not exceed $5 per foot. The Steel Works Company furnished fuel and water; the cost of water did not exceed $3 per day. The casing is 6 inches in diameter. The well is cased 230 feet. Surface water was reached at 22 feet; second water at 200 feet, bu it amounted to scarcely one barrel per day of twenty-four hours. I used the same ma chinery here that I used at Servilleta. The location of the well is on the mesa, abou 125 feet above the level of the Arkansas River."

THE BORING NEAR CHEYENNE, WYO.

At Fort D. A. Russell, about 3 miles from Cheyenne, Wyo., a boring was mad some years ago. Lieutenant O'Brien is the only person I could find who could giv me any information concerning it. He informed me that he was at the fort whe the boring was made, and that water was struck at about 40 feet from the surface i small quantities. The first casing was 8 inches in diameter, into which a smalle pipe was inserted. The depth reached was 800 feet, all the way through gravel an bowlders. No bed-rock was reached, nor any water obtained, except the surface wat at 40 feet. The work was then abandoned.

THE BORING AT KIT CARSON, COLO.

Mr. W. W. Borst, superintendent of the western division of the Atchison, Topek and Santa Fé Railroad, gave me the following data concerning the boring that wa made some years ago at Kit Carson station, on the Kansas Pacific Railway: "Th well at Kit Carson was begun in 1870 by the Kansas Pacific Railway Company, unde the direction of General William J. Palmer, now president of the Denver and Ri Grande Railroad Company. I think a lime shale was struck at less than 100 feet fro the surface, and that the drill never went through it. I do not recollect that an surface water was reached. I think the boring was carried down about 1,300 fee The boring was abandoned without obtaining water. I do not know the cost."

Although I visited the place, I was not able to obtain any further information co cerning this boring; nor was I able to find the exact site of it, as all trace had bee obliterated.

STATISTICS OF METHODS AND COST OF BORING.

After returning from the plains, with the approval of the department, I visited th oil regions of Pennsylvania to study the best methods and most approved tools fo boring wells. I visited Franklin, Oil City, and Bradford, at all of which places found extensive borings for petroleum. The large experience here in well-drillin has probably developed the best methods of well-boring, and produced tools the bes adapted to rapid and perfect work. So far as I could learn, the only tools used her in boring wells are the club churn drills, worked with a steam-engine, usually 1 horse-power, with walking-beam and rope. This drill bores by percussion, and co sists of what is locally called an auger-stem, sinker-bar, jars, and bit, the whol together weighing from 1,400 to 2,000 pounds,

The work performed with these tools in twelve hours is from 40 to 50 feet, and ex ceptionally 75 feet. On a double shift in the twenty-four hours from 80 to 100 fee have been bored, the amount depending upon the nature of the rock.

The usual method of contracting for drilling wells here is as follows: The part desiring the well bored furnishes an engine and builds a derrick. The party co tracting to bore the well furnishes the tools, fuel, water, and labor, and drills the we for from 50 to 60 cents per foot.

I herewith give a comparison of the work performed in a given time by the walkin beam churn drill, such as is used in the Pennsylvania oil regions, and the work pe formed by the diamond drill, such as was used at the government well near Fo Lyon, as learned from information obtained in the oil region, and from Mr. Douglass the superintendent of the well at Fort Lyon:

	Feet
Twelve hours' performance of walking-beam churn drill	4
Twelve hours' performance of diamond drill	1

This gives an amount of work for the churn drill three times as great as that of th diamond drill.

With a double shift the amount of work for the churn drill is nearly as great pro portionally in excess of the diamond drill, each being as follows:

	Fee
Twenty-four hours' performance of walking-beam churn drill	9
Twenty-four hours' performance of diamond drill	3

In the foregoing comparison the maximum amount of work is given of which th diamond drill is capable, as stated to me by Mr. Douglass, while only the averag work of the churn drill is given. This comparison is based upon the supposition tha the rock to be bored is not of extraordinary hardness, and no estimate is made as to accidental breakage of machinery or tools in either case, or of delays from other causes. The churn drill is of great simplicity, is easily sharpened by a blacksmith, and only slight friction has to be overcome in working it.

A constant stream of water must be forced down the inside of the boring-rods of the diamond drill, which are hollow, to force the cuttings up outside those rods. This requires a large quantity of water, much more than is used by the churn drill. Where the water has to be hauled from a distance this is a serious additional expense. The churn drill requires three men to work it. The diamond drill requires three men besides the diamond-setter.

COST OF LABOR AND MACHINERY.

The average price of soft coal at the points visited in Colorado and New Mexico I found to be $5 per ton at the railroad depots. The average cost of skilled labor is $4 per day; that of common labor, $2 per day. The cost of two-horse teams with driver, $4 per day. The price of work-horses is from $75 to $150, according to quality. The average cost of drilling wells in Colorado, New Mexico, and Nebraska I found to be $4.50 per foot. This does not refer to the government well at Fort Lyon.

Fifteen-horse-power steam-engines, with boiler, adapted to well-drilling, could be purchased of the South Pueblo Machinery Company for $950. This was the only establishment I found in the West where such engines are for sale. Mr. B. P. Fry, of Oil City, offered 15-horse-power engines and boilers suitable for well-drilling for $600, and drilling tools complete for $600 more. The latter includes "fishing-rods," and embraces a complete "rig," except the rope. Six-inch casing costs in Pennsylvania 85 cents per foot, 2-inch pipe 22 cents per foot, and 1-inch pipe 8 cents.

In some localities it might be more economical to lay pipe-lines and force water to the point of operations for the supply of the boiler and drill than to haul it with teams. The cost of a 1-inch pipe, which would probably be sufficiently large to lay one mile, would be $465.65.

In view of the observations which I have made, I am confident that it will be much more economical for the department to bore any wells that may hereafter be ordered by contract. Competitive bids by competent parties would insure the lowest price obtainable, and it would relieve the department of vexatious labor and the government from much loss of money.

Respectfully submitted.

HORACE BEACH,
Commissioner.

PRAIRIE DU CHIEN, WIS., *December* 24, 1881.

DENVER, COLO., *November* 10, 1

SIR: I have the honor to acknowledge the receipt of your letter of the 7th in
wherein you request me to "report what has been done in the selection of sit
artesian wells, contracts made, and work done," to which I hasten to reply.

After looking much of the territory over, designated in my instructions, I lo
Well No. 1, 112 miles easterly from the city of Denver, upon government land,
the station of Akron, on the Burlington and Missouri Railroad, in Colorado.

Subsequently I located Well No. 2, 177 miles southeasterly from Denver, upon
ernment lands, near the line of the station of Cheyenne Wells, on the Kansas P
Railroad.

Each location has been made with reference to the probability of obtaining
upon good lands, and so as to be useful, if successful, for irrigating purposes or
ing stock.

In making these locations it was necessary to have water near by to suppl
boiler of the engine which furnished the power for drilling. At both locatio
railroad companies have generously agreed to furnish the water at their st
without charge.

After making these locations I found the lands upon which I had located the
were liable to homestead, pre-emption, or tree claims. This difficulty was afte
removed by withdrawing the sites selected from entry.

After securing the sites, specifications were published in the principal pap
Denver, and printed in handbills and circulated through mails, asking propos
doing the work.

The contract was awarded on the 24th day of September to James A. Flem
Co., of Denver, Colo., for the sum of $14,500, for drilling both wells to the de
2,500 feet each (if required), and the contractors furnish all the material neces
do the work and pay all employés at their own expense.

The wells were divided into sections as follows: First 1,000 feet, and the bal
the 2,500 feet into 500-feet sections, the Department of Agriculture retaining the
to stop the work at any distance below 1,000 feet and pay pro rata for the dis
bored.

Upon the execution of the contract, James A. Fleming, of the firm of J
Fleming & Co., proceeded to Bradford, Pa., and purchased the requisite mach
for doing the work.

The machinery was to be shipped to Akron on the 10th of October, but did n
rive at Akron until the 9th of November, causing much delay in the execution
work.

The machinery is now in process of erection, is massive, and of the best qu
The contractors have brought four experienced drillers from Bradford, each h
an experience of from ten to seventeen years in drilling deep wells.

The work of drilling will commence very soon under favorable conditions.

Respectfully,

HORACE BEACH,
Artesian Well Commissio

Hon. GEORGE B. LORING,
Commissioner of Agriculture, Washington, D. C.

AKRON, COLO., *November* 10, 1

SIR: I have the pleasure to inform you that the machinery derrick, already fr
has arrived here and is in process of being put up. The whole material weighs
forty-five tons, and looks as if it is of the very best quality. They have broug
kind of tools which they are likely to want in any contingency. The railroads
been very slow in forwarding the rig, it taking nearly one month to bring the
rial from Bradford, Pa., to this place. I expect in a very few days the work of
ing will be commenced.

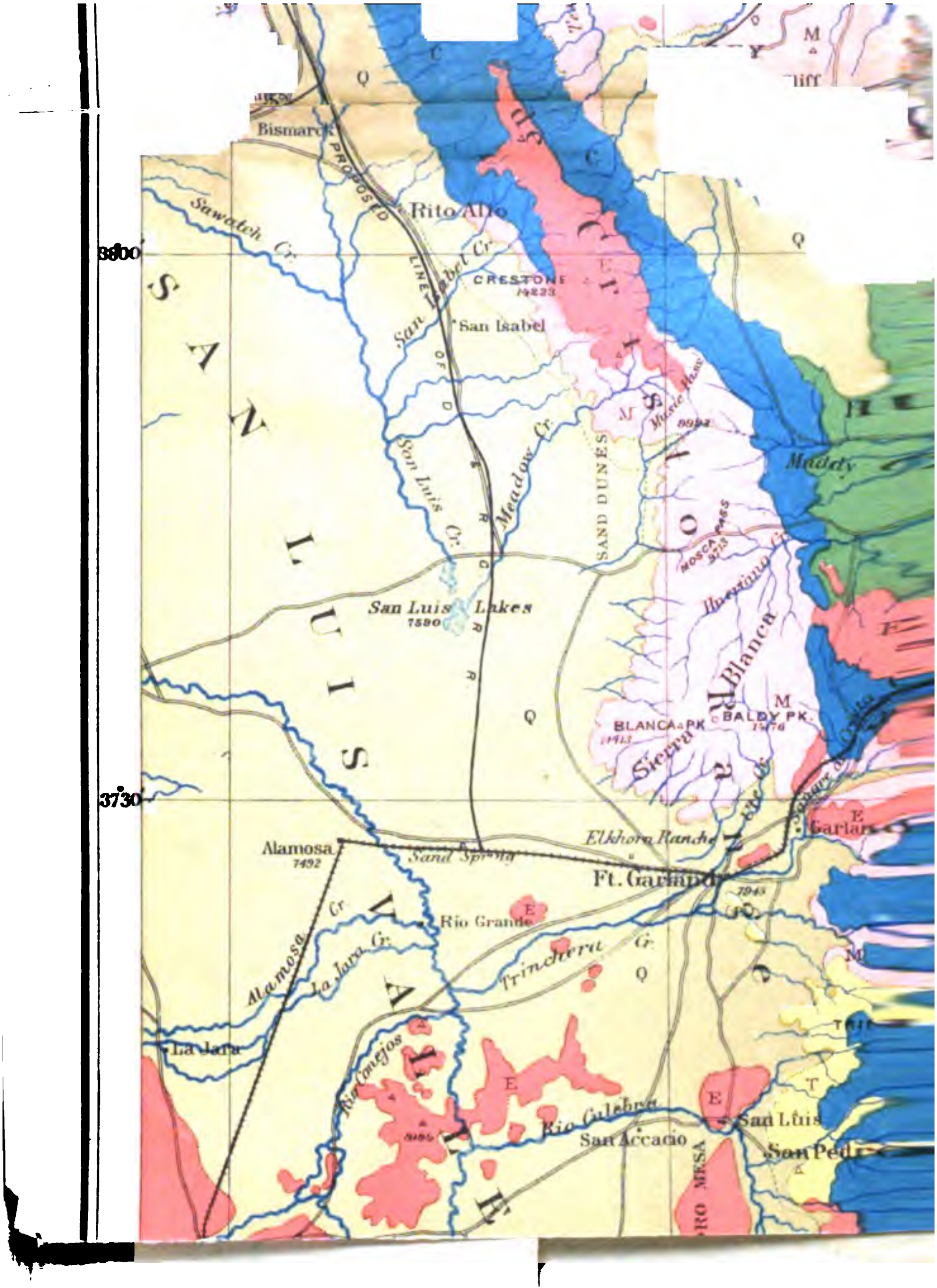
The contractors have brought on four stalwart drillers, men who have had e
ence of from ten to seventeen years in drilling deep wells. Everything bids fa
the successful prosecution of the work.

I will advise the Department by mail as the work progresses.

Respectfully,

HORACE BEACH,
Artesian Well Commissio

Hon. GEORGE B. LORING,
Commissioner of Agriculture, Washington, D. C.



SAN LUIS VALLEY
Sierra Blanca
BLANCA PK 14463
BALDY PK. 14176
M
MOSCA PASS 9713
SAND DUNES
Music Pass
8994
Muddy
Huerfano Cr.
CRESTONE 14223
San Isabel
San Isabel Cr.
Rito Alto
Bismarck
PROPOSED LINE OF D. & R. G. R. R.
Sawatch Cr.
San Luis Cr.
Meadow Cr.
San Luis Lakes 7590
Q
3800
3730
Alamosa 7492
Sand Spring
Elkhorn Ranch
Ft. Garland 7945
Garlan
Rio Grande
Alamosa Cr.
La Jara Cr.
La Jara
Trinchera Cr.
Rio Conejos
Rio Culebra
San Accacio
San Luis
San Pedro
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REPORT

ON THE

CLIMATIC AND AGRICULTURAL FEATURES

AND THE

AGRICULTURAL PRACTICE AND NEEDS

OF THE

ARID REGIONS OF THE PACIFIC SLOPE,

WITH NOTES ON ARIZONA AND NEW MEXICO.

MADE UNDER THE DIRECTION OF

THE COMMISSIONER OF AGRICULTURE,

BY

E. W. HILGARD, T. C. JONES, AND R. W. FURNAS.

1882.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1882.

Act [illegible]

[illegible]

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LETTER OF TRANSMITTAL.

Hon. Geo. B. Loring,
Commissioner of Agriculture:

SIR: I transmit herewith a report of the commissioners appointed by you in August, 1881, in pursuance of a provision made by Congress "for procuring data touching the agricultural needs of that portion of the United States lying west of the Rocky Mountains and the Arid Region."

This commission was composed, besides myself, of the Hon. R. W. Furnas, of Brownsville, Nebr., and Judge T. C. Jones, of Delaware, Ohio; the former gentleman prominently identified with the horticultural interests of his State, and the latter well known as a prominent breeder of short-horn and other improved breeds of cattle. Your instructions to the commission embraced the following points:

To institute investigation and make reports upon—

1. The grape-culture and wine-making of the Pacific coast as it now exists, and especially the inducements offered by the soil and climate of New Mexico for viticulture, in reference to supplying the market with valuable grapes, wines, and raisins.
2. The animal industry of that portion of our country, its value, condition, and management generally, including cattle, horses, sheep, and swine.
3. The agricultural methods prevailing in the region designated, including cereal crops, their value, amount in aggregate and average yield per acre, the general management of land for horticultural as well as agricultural purposes, and the modes of fertilization.

You further requested me, as chairman of the commission, to appoint a meeting of the members on this coast as early as possible. Fearing that the pressure of other duties and engagements already incured would prevent me from taking as active a part in the work of the commission as the case seemed to require, I hesitated to accept the charge, and so informed you. As, however, for reasons satisfactory to yourself, you declined to make another appointment, I consented to act, as far as practicable under the circumstances, in assisting my colleagues in their labors, and in editing and supplementing their reports.

Messrs. Furnas and Jones met me here September 6, and immediately took the field, visiting successively such portions of the State as were of most immediate interest in view of the progress of the vintage, fruit harvest, and agricultural exhibitions. Toward the end of October they left the State on the southern route, making observations in Arizona and New Mexico, and reaching home early in November. Their reports on their respective spheres of observation reached me about the middle of January of the present year.

In editing and completing this report I have deemed it best, and in accordance with the object of the commission, to leave each member to formulate and record his own observations and opinions in those matters in which he felt himself most competent to form his judgment. It would be disingenuous to disguise the fact that, especially as regards California, a great deal has been said and written that is popularly considered as partaking largely of the bias usually ascribed to travelers in foreign parts—a kind of mild exaggeration, born of local enthusiasm and a safe distance from close criticism. This tendency to grandiloquence is, moreover, supposed to infect promptly any one who for any length of time exposes himself to the bewitching influence of California air and sunshine. Recognizing, therefore, the wisdom of your selection of two trustworthy and impartial judges, identified with the interests of their respective States, to observe and report on their respective specialties, I have made a point of allowing them to come to their own conclusions from the facts before them. If in expressing these opinions they have to a considerable extent adopted the language of California writers on the subjects in hand, I can but say that, having used the most commendable diligence and energy during the time at their command, they have every reason to know from personal observation the actual facts of the case.

So far, then, as the subjects treated by my colleagues are concerned, I have confined my own remarks to comments, or the making up of accidental omissions, in the body of their respective reports; distinguishing such intercalations, however, by my initials placed at the end.

As regards the matter contributed by myself, I have, in treating of subjects that have heretofore engaged my attention, made free use of such portions of the reports previously made by me to the regents of the University of California as bear upon the objects of the Commission. The limited publicity given to these reports outside of California, renders their contents substantially new to the general public, especially in the new connections in which the recasting has placed them.

If it should be thought invidious that the commission has given its chief attention to California, it seems to me that, even apart from the instructions above quoted, such action can be justified upon the ground that it is in California that the various conditions found in the "Arid Region of the United States" are realized within the smallest space, and have been longest subject to experiment and experience on the part of an intelligent and enterprising population.

Had the limited means at the command of the commission been spread over the whole of the territory west of the 100th meridian, the results would have been of so general a nature only as to add little to what is contained in the excellent report of General Powell. It may properly be presumed to have been the intention of Congress, in making the appropriation, to obtain something more detailed and specifically technical than the data given by General Powell, and with the means provided detailed study could not usefully be extended over any very wide area.

I would have greatly desired to add to the present report data relating to the peculiar conditions governing agriculture in Eastern Oregon, Washington, and Idaho, the region soon to be opened to communication with the world at large by the completion of the Northern Pacific Railroad. But my personal observations in that country have been too limited as yet to enable me to give more than a fragmentary account, and the time at command of my colleagues did not allow of such extension of the scope of their work.

All of which is respectfully submitted.

E. W. HILGARD,
Chairman of Commission.

BERKELEY, CAL., *March* 4, 1882.

INTRODUCTORY REMARKS ON THE WORK OF THE COMMISSION.

BY R. W. FURNAS.

Comparatively speaking, new conditions are found in California. Originally, what is now the State was regarded only as a mining region. The peculiar and admirable climate, even, was regarded as incidental, and of no particular practical value. The valleys, before the rush for gold, were considered valuable for grazing purposes, it is true. But isolated as they were, and the population sparse, the time was when cattle and even horses were actually slaughtered as a means of protecting the meager growing crops necessary to subsist settlers. After the gold fever had run a course, as it were, attention was given to tilling the soil, which was found peculiarly adapted to wheat, barley, and fruit-growing. Since that time great superiority has been claimed for these three industrial factors. For fruits of nearly all kinds, more especially the citrus family of semi-tropical fruits, wines, and raisin grapes, peaches, pears, plums, prunes, and figs, unequaled characteristics in matter of soil, climate, yield, quality, &c., have been claimed, and, after investigation, were almost universally conceded.

Both the limited appropriation and time at command of the commission were such as to preclude detailed visitation and personal observation of *all* localities. The object, therefore, has been to see and observe, so far as circumstances would admit, representative sections.

As a rule, the efforts of the commission were heartily seconded, and no pains spared to enable members to accomplish the objects desired. Special mention is due Hon. Horace Davis, ex-member of Congress, San Francisco, who was the author of the appropriation clause under which the commission acted. Also, A. N. Towne, T. G. Goodman, J. C. Stubbs, and B. B. Redding, of the Central Pacific Railroad offices, for use of records and statistics obtained through their courtesy. Prof. E. J. Wickson, editor of the Pacific Rural Press; Lathrop Brothers, Palo Alto; Judge B. P. Rankin, San José; J. B. Armstrong, Santa Rosa; R. J. Poppe, Sonoma; Prof. George Husmann, Napa; E. F. Smith, secretary of the State Board of Agriculture, Sacramento; Jewett and Decker, Marysville; General John Bidwell, Chico; I. W. Ferguson, Fresno; Ford Roper, Bakersfield; George Rice, secretary of the Southern Horticultural Society, Los Angeles; Elwood Cooper, Santa Barbara; Major Chace, San Diego; N. C. Carter, San Gabriel; Professor and Mrs.

Carr, Pasadena; S. C. Evans, Riverside; Russel Heath, Carpenteria, and others.

The facts and figures given were principally obtained on the spot, from actual observation and records.

In making up this report the writer has made liberal use of the reports of viticultural and horticultural commissioners, as will be seen by comparison, in some instances copying *verbatim.* Mainly, however, a condensation of both diction and matter, where used, has been made.

CLIMATES OF THE PACIFIC SLOPE.

By E. W. Hilgard.

The small visual angle subtended by the long stretch of coast from the Straits of Fuca to San Diego, at the distance from which it is viewed by the bulk of the population of the United States, and the fact that it is occupied by but two States and one Territory, makes it difficult for the popular mind to realize the great differences of climate embraced within these sixteen degrees of latitude, which on the Atlantic coast cover the coast line between the Gulf of Saint Lawrence and Charleston, S. C. It is true that as regards both the mean annual temperatures, and the lower extremes particularly, the difference between Cape Flattery and San Diego is very much less pronounced than on the Atlantic side, where the desolate shores of Labrador at once announce the confines of the Arctic regions, in striking contrast to the forest-clad hills that gird Puget Sound. Yet, while the conditions of temperature are such as to permit the culture of the same familiar flowers, garden and even some field crops, at Victoria and Los Angeles, the differences in the agricultural practices brought about by the variation in the rainfall are far greater than exist along the entire extent of the Atlantic coast. From Cape Sable of Nova Scotia to its namesake of Florida, a humid climate, with summer rains, prevails, and the cultivator of the soil is governed in his operations almost exclusively by the conditions of temperature; his time for sowing and harvesting is controlled and limited simply by the end and beginning of winter.

The same familiar *régime* prevails on the northern portion of the Pacific coast, in Washington Territory, Oregon, and the most northern part of California; and it is, doubtless, for this reason that so large a portion of the immigration to the coast from the northern countries of Europe tends in that direction. There the Scandinavian and North German has nothing new to learn; he finds only a fatherland under improved conditions, even to the plants familiar to his childhood, pine forests, mountains, and endless drizzling rains, the total annual outcome of which would at times reach several inches above his head. This region of heavy rainfall extends southward into California, to where the Sierra Nevada and the Coast Range unite in the grand mountain mass of Shasta. In the valleys surrounding that volcanic peak, the rain-gauge has accumulated as much as 108 inches of water in one season; but here already it falls in torrents during a comparatively short rainy season, many inches at a single downpour, with only an occasional thunder-storm from June to October, already indicating the approach of the region of rainless summers, which embraces by far the larger portion of the State of California. In the Sierra Nevada, of course, the summer rains extend farther to southward than in the Coast Range, and in the valleys, where the inhabitants can often see the dark cloud-caps gathering around the peaks, emitting flashes of lightning whose echoes fail to reach them, and not disturbing in the least degree the serenity of the blue sky overhead or the intense dryness of the atmosphere. Thus the rainfall of 20 inches is carried in the high Sierras as far as the heads of Kern and King's Rivers, furnishing the water-supply upon which depends the irrigation of the fertile soils of the San Joaquin Valley. Thence southeastward, the annual rain gauge abruptly descends to 8 and even 4 inches in the arid plain of the Mojave desert and the basin of Nevada.

Along the coast proper Cape Mendocino bears the reputation of a kind of water-divide: Mariners expect a change of weather whenever they round it, and on land it marks the region where the character of vegetation begins to change rapidly from that of Southern or Middle California toward that of Oregon at and immediately north of the cape: the rainfall reaches an annual mean of 36 inches. A short distance southward, at Point Arena, it is only 20 inches; and, rising slightly in the region of San Francisco, it falls to 16 on the Bay of Monterey, 12 at Santa Barbara, and 8 to 10 at San Diego.

A similar but somewhat more rapid decrease of rainfall is observed in the Great Interior Valley. From 40 inches at Redding, its extreme northern end, and 25 inches at Red Bluff, 24 miles to southward, the annual mean falls to about 19 inches at Sacramento and to 16 at Stockton. Thence southward, the rainfall descends to a mean of only 10 inches at Merced, 7½ at Fresno, and 4¼ at Bakersfield, near the southern end of the San Joaquin Valley, and separated only by the Tehachipi Mountains from the western margin of Mojave desert, in which the rainfall is still less.

Were these rainfalls of 20 inches and less distributed over the whole or even the greater part of an ordinary season of the temperate zone, it would be altogether inadequate for the growing of cereal or other usual crops of that zone; but since in California nearly the whole of it usually falls within six months (November and April, inclusive), and by far the greater part within the three winter months, during which a "growing temperature" for all the hardier crops commonly prevails, it becomes perfectly feasible to mature grain and other field crops before the setting in of the rainless summer, provided only that the aggregate of moisture has been adequate, and its distribution reasonably favorable. The grain sown into the dust of a summer-fallowed field begins to sprout with the first rain, and thenceforward grows more or less slowly, but continuously, through the winter; is ready to head at the first setting-in of warm weather, from the end of March to May, according to latitude; and becomes ready for the reaper from the end of May to that of June. Once harvested, the grain may be left in the field for several months, threshed or unthreshed, without fear of rain or thunderstorms. As a matter of course, the grain-grower may also sow his grain at any time after the beginning of the rains at his option; and good crops are sometimes obtained from sowings made late in February. Usually, however, the late-sown grain is cut for hay when in the milk, in April and May; for since meadows can form no part of the agricultural system except where irrigation is feasible, the hay grasses commonly grown in the Eastern States are available only to a limited extent, and wheat, barley, and oats take their place. Again, there is no strict distinction or limit between fall and spring grain, since the sowing season extends from October to February. Thus, the winter months are a very busy season for the farmer in California, as he has to watch his opportunity for putting in his crop between rains. The time between laying by and harvest is nearly filled up by gardening and hay-ing operations. The latter are occasionally interrupted by one or two light showers, rarely enough to injure the quality of the hay. Protracted rainy "spells," or thunder-storms, calling for a hasty gathering of the cut grain into cocks, are unknown in harvest time, hence spoiled or sprouted grain is scarcely thought of, except only in case of the sacked grain being left out so late as to catch the first fall rains.

It will thus be seen that while the winter months are the busiest season for the California grain-grower, midsummer finds him comparatively at leisure; the threshing of the grain crop and the baling of hay (both usually done by itinerant gangs of contractors) being all that is on his hands until the coming of the rains. It goes without saying that the California summer is vastly better adapted to the enjoyment of leisure than an eastern winter. In view of this peculiarity of the growing season of California, the propriety of counting production, rainfall, &c., by such "seasons" instead of calendar years, becomes obvious; and it is the universal and unconscious practice to do so. From this practice arises, also, some differences in the means of rainfalls as given in the Smithsonian tables on the one hand, and the "season tables" of California, herein adopted, on the other. But while the culture of hardy plants of rapid development was the first and most obvious expedient resorted to in order to utilize the fertile soils of the "arid regions" of California, that of selecting culture plants adapted to an arid climate was also soon tried. The way has been tried by the missionary Padres, who brought with them from the similarly arid climates of the Mediterranean region of the Old World the vine, the fig, the olive, and the citrus fruits—the lemon and orange. To these have since been added the fruits of the entire temperate and subtropical zone, each of which finds the proper conditions of success in some of the many and endlessly diversified climatic areas, zones, islands, and nooks which meet the traveler unexpectedly all over the State, and among which the most fastidious taste can hardly fail to discover something suited to his idiosyncrasy. It is this diversity, this constantly recurring charm of novelty and undeveloped possibilities that casts a spell over all those who have once experienced it, and are not governed merely by the desire for gain, but also by that of home-making. California has for years ceased to be the country of rapid fortunes, and many more have doubtless been lost than gained by indiscreet investments prompted by the still uneradicated tendency to risk all upon the accidents of a game, a mine, or a season; yet even those whom fate has not favored, and who have long left its shores, look back to California, its sunny skies and marvelous contrasts, with a feeling akin to that with which the Swiss emigrant remembers his native mountains and valleys.

WINDS.

The prevalent winds of the Pacific coast are from the west, the influence of the Pacific Ocean thus producing a temperate climate. This effect is partially cut off from the interior valley by the Coast Range, which also intercepts a part of the moisture carried by these winds; the remainder is condensed by the Sierra Nevada and Cascade Ranges, thus producing the arid continental climate of the interior plateau of Nevada, eastern Oregon and Washington.

North of Cape Mendocino the direction of the prevailing currents is more from north of west; southward, due west or slightly south of west, forming the "summer trade winds," which set in regularly some time in

May, and continue, with but an occasional interruption by a "norther," until October, laden with moisture from the warm high seas. In summer they strike the cold Alaskan Ocean current which comes to the surface and sets in-shore off Central California, producing dense fogs which during the summer months frequently cover the Coast country for 20 out of 24 hours, for weeks together. Beyond a slight drizzle, however, no water falls; and as the fog banks drift against and up the slopes of the Coast Range, they dissolve quickly before the intense heat and dryness of the summer atmosphere beyond. The moisture absorbed by the soil of the coast belt from these fogs goes far, however, toward maintaining the growth of the hardier herbaceous as well as of woody plants, no less than that of weeds, during the season of drought. In the great interior valley, the general direction of these winds is changed to "up-valley," that is, a little west of south in the Sacramento, and west of north in the San Joaquin Valley; a heavy westerly breeze flowing in, as a rule, through the joint outlet of these valleys, the Strait of Carquines.

From May to October, both inclusive, south winds are very rare, but during the winter months they bring the rains upon which the success or failure of crops depend. The winter rain-storms are usually heralded by heavy weather in Oregon or in the Shasta region, whence the rain wind works backward, so to speak, until it exhausts itself in the southern part of the San Joaquin Valley, where the San Fernando Range seems to form a partial weather divide, leaving the Los Angeles region more or less independent of the changes to northward. Sometimes the rain-storm works chiefly down the coast, leaving the great valley almost dry, in which case Los Angeles and San Diego usually get a fair proportion of benefit. Sometimes prolonged and severe storms cover the entire State, and extend far into Arizona and British Columbia. As thunder and lightning rarely form a part of the atmospheric disturbance, the rain usually falls gently and continuously rather than in torrents, and thus chiefly soaks into the ground, but sometimes a fierce south wind drives it for a day or two, and then generally there comes a change; the wind gradually veers to the westward, and then more rapidly to northwest and north, and with a heavy shower the sky clears suddenly and the "norther" sets in. Though not ordinarily bringing a very low thermometer, it often feels bitingly and penetratingly cold, because of its velocity and dryness, causing rapid evaporation. Before it the surface moisture quickly disappears, muddy roads become as rough as if frozen, and compact ground cracks after a few days. Any long prevalence of this wind is looked upon with dread at all seasons, on account of the waste of moisture which it involves even when cold. In autumn and spring, when its temperature is higher, the young grain often withers before it, and from May to September (when it fortunately is of rare occurrence), it sometimes becomes a veritable simoon, like the breath of a hot furnace, shriveling up the grain when in milk, and sometimes almost curing into hay the standing crops. To seaward of the Coast Range it is rarely of long duration, three days being its ordinary limit; but in the Great Valley, and especially in that of the San Joaquin, it is both more frequent and persistent, occasionally blighting in a week all the hopes of the grain-grower not able to resort to irrigation, and even drying the fruit on the trees. East winds are only of brief and local occurrence, being ordinarily cut off by the mountain ranges in their north and south course. They are usually the precursors of a "southwester" with rain.

CLIMATIC REGIONS OF CALIFORNIA.

The climatic subdivisions of California may conveniently be considered under the following heads, transition zones of greater or less extent intervening between the areas here defined:

1. The coast climates, with cool summers and warm winters, the ground rarely freezing even superficially, except in most northerly portion; westerly winds predominant. Subdivided into—

A. Region near and north of Cape Mendocino, with from 30 to 80 inches of annual rainfall, occasional summer showers and thunder-storms. Transition to the Oregon climate. Mean winter temperature of Eureka, 47°.0 F.; mean summer temperature, 58°.2 F.

B. Region of San Francisco Bay, southward to Santa Cruz, with from 25 to 16 inches of rainfall, and heavy summer winds and fogs; practically no summer showers. Average winter temperature at San Francisco, 51° F.; summer. 56° F.

C. Southern coast region, from Monterey to San Diego, 12 to 8 inches of annual rainfall; fewer fogs than in the San Francisco region; irrigation ordinarily needed for field crops. Mean winter temperature: Santa Barbara, 54°.3 F.; San Diego, 54°.6 F. Summer: Santa Barbara, 68°.2 F.; San Diego, 69°.1 F. Extreme temperatures: Santa Barbara, 33° and 98° between 1870 and 1880. Mean humidity, 69°.5; variation from 64° to 74°.

2. Climate of the Great Valley of California, with high summer temperature and intensely dry atmosphere; no summer fogs. Subdivided into—

A. Climate of Sacramento Valley, with 20 to 40 inches rainfall; little irrigation. Mean winter temperature of Sacramento, 47°.9 F.; summer, 71°.2 F.

B. Climate of the San Joaquin Valley, with 16 to 4 inches rainfall. Irrigation needed for safety of all field crops, and more or less for all others. Winter temperature at Visalia, 45°.4 F.; summer, 80°.8 F.

C. Climate of the foothills of the Sierra Nevada, up to 2,000 feet elevation. Rainfall greater than at corresponding points in the valley, increasing at the rate of about one inch for every 150 feet. Summer temperature about the same as in the valley.

3. Mountain climates of the Sierra Nevada and Northern California (Siskiyou and Shasta region). Summer and winter well defined, snow lying during several months; rainfall from 20 at the south to 100 inches at the north. Region of fir and pine forests, and pasturage.

4. Semi-tropical region of South California: Los Angeles, San Barnardino, and San Diego Counties. Rainfall, 8 to 12 inches; irrigation universal; frosts rare, permitting the culture of semi-tropical fruits in the open air, despite of an occasional cutting back in severe seasons.

5. Arid Plateau climate of the Mojave and Colorado Deserts. Rainfall from 8 to 4 inches and less, irregular, some seasons almost none, so that annual vegetation lies dormant; to southward bordering the region of summer rains of Arizona and New Mexico.

VARIATION AND PERIODICITY OF RAINFALL.

While the means of rainfall above given will not vary widely when a number of years are taken together, the variations from one year to another are often sufficiently great to tempt many to invest heavily in putting in crops on the chances of a favorable season, which would bring a fortune at one venture, but sometimes result in a total loss, and consequent ruin to the investor. Such cases of agricultural gambling were at one time not uncommon, in the San Joaquin Valley especially; the turning point of profit or loss being a single light shower at the critical time, or the occurrence of a norther for a day or two. Much ingenuity has been spent in trying to forecast the weather for season in time to determine the chances of success; but it will generally be found that the oldest citizen, if he is candid, will be far more reserved in his opinions than later comers. However steady and reliable the summer climate may be, that of California winter is more difficult to forecast from day to day and from week to week; and, while there are certain rules that are ordinarily counted upon, the cases where "all signs fail" are very frequent, and surprises are abundant. A discussion of the observations made from 1849 to 1877, by Dr. G. F. Becker, late of the University of California, and now of the United States Geological Survey, seems to indicate as probable a cycle of thirteen years between extreme minima or drought years; and some data I have since obtained from the records of the missions seem to confirm still further this conclusion. The first minimum, within the time of the American occupation of California, occurred in the season of 1850–'51, when the rainfall at San Francisco (where the mean is 23½ inches) was only 7.4, while it had amounted to 33.1 the year before; the second minimum occurred in 1863–'64, when the rainfall at San Francisco was 10.1 inches; and the third was the season of 1876–'77, with 10 inches. The next succeeding season of minimum would be that of 1888–'89.

The following table, given by Dr. Becker, exhibits these facts, as also the probabilities deduced for the intervening years, from a discussion of the nature of the curves representing the observations.*

*Observations, periodicity, and probabilities of rainfall, San Francisco.**

Years.	Rainfall.	Years.	Rainfall.	Position in period.	Probabilities.
1850–'51	7.40	1863–'64	10.08	I	11.50
1851–'52	18.44	1864–'65	24.73	II	20.50
1852–'53	35.26	1865–'66	22.93	III	27.40
1853–'54	23.87	1866–'67	34.92	IV	30.50
1854–'55	23.68	1867–'68	38.84	V	28.30
1855–'56	21.66	1868–'69	21.85	VI	23.30
1856–'57	19.81	1869–'70	19.31	VII	19.30
1857–'58	21.88	1870–'71	14.10	VIII	19.60
1858–'59	22.32	1871–'72	34.71	IX	25.00
1859–'60	31.22	1872–'73	18.02	X	28.20
1860–'61	19.72	1873–'74	23.98	XI	28.50
1861–'62	49.27	1874–'75	18.40	XII	28.50
1862–'63	13.62	1875–'76	26.01	XIII	19.00
Totals	308.05		307.38		309.60
1849–'50	33.10	1876–'77	10.00		

*Tennent's gauge.

Similar tables for Sacramento and Stockton exhibit the same general features.

From information kindly furnished me by H. H. Bancroft, esq., of San Francisco, it appears in the records of the early explorers of California the year 1805 is known as "El año del hambre" (the hungry year), the drought having been extraordinarily severe; and nearly the same account is given of the year 1817. It will be observed that these dates indicate a period of twelve years between themselves, and that the interval from the last mentioned date to 1877 (for those drought years as yet no data have been found) is also divisible by the same number. It is quite intelligible that as the result of several concurrent and variable causes the period may vary between such limits as twelve and thirteen.*

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* See Bulletin No. 31 of the University of California, February, 1878.

Should further observations confirm the existence of this definite periodicity, the forecast even to this extent would be of immense service to agriculture in California, since the nature of the crops, as well as their treatment, could, in a measure, be adapted to the circumstances of these "lean years." Still the portion of the valley lying south of Stockton will always be a region of predominant irrigation, while in the northern portion a proper and intelligent co-adaptation ot crops and soils can render agriculture more or less independent of that necessity. As the matter now stands it is estimated that in the southern portion of San Joaquin County one good crop out of three may be made without irrigation, while south of Merced one in five is about all that can be counted on in the undulating uplands bordering the foothills. Other things being equal, much of course depends upon the nature and depth of soil, the perfection and depth of tillage, and the practice of after-cultivation as against broadcasting. To guard against the effects of northers, and to prevent all avoidable evaporation of the precious moisture, it is the universal practice to roll the grain-fields as late as it can be done without injury to the growing grain. On sandy soils this can hardly be overdone; but on clay soils, should they be too wet when rolled, the effect will be the exact reverse of what is desired, and great injury often results.

It is the general estimate that whenever the rains have been adequate to make the moisture from above meet that rising from below, a crop may be secured, if the season be reasonably favorable. And since the depth at which moisture is found at the end of the dry season will, other things being equal, depend upon the amount of rainfall during the previous season, it makes a material difference whether a droughty season has been preceded by a wet one (as was the case in 1850–'51), or whether a scant rainfall preceded a deficient one. In the middle portion of the valley the summer's drought will, on untilled soils, reach to the depth of from 3 to 5 feet, according to the nature of the soil; and this mass has to be remoistened fully to that depth to give promise of success for field crops. When the surface has, on the contrary, been kept in a state of good tilth during the summer ("summer fallowed"), the moisture will be found at a much less depth; the remoistening by the fall rains will be proportionally more rapid, and the chances for a crop materially increased from that cause alone.

In the extreme south of the San Joaquin Valley the annual rainfall rarely moistens the soil to a greater depth than 2 or 3 feet; and in digging or boring wells in districts not irrigated the materials are found dry as dust to the depth of 40 feet, and even more. At the first beginning of irrigation this entire mass has to be moistened before moisture will permanently remain within reach of the tap-roots of plants, and a very large amount of water is therefore at first required; but gradually the ground fills up, the water table, and with it the plane of moisture, rises more or less rapidly, the effect becoming perceptible at the distance of many miles in the porous soils of the plains; and ultimately the amount of water annually needed for irrigation becomes several times less than that needed during the first years.

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* See my article on "The Soils and Agriculture of California," in Report of the Department for 1878, p. 478.

TIMBER AND FOREST CULTURE.

The occurrence of timbered lands is mainly governed by the existence of the proper moisture conditions. In the arid regions, therefore, we find timber belts of more or less importance bordering the streams, and thus marking their course at a distance; and we likewise find them forming large bodies on mountain chains whose elevation is sufficient to increase the rainfall to an adequate extent, and from these descending to a lower level in valleys, on usually the side least exposed to the afternoon sun. Apart from the denser forest growth of the mountain proper, we find, especially on the Pacific slope in California and Arizona, a scattered growth of hardy drought-resisting trees (largely oaks), which dot the plains and hill lands, producing the appearance of a park, or, as it is commonly expressed, "of an orchard," the low, rounded forms of these oaks resembling more that of orchard trees than their brethren of the oak forests east of the Mississippi. This feature is familiar in most of the pictures representing scenery on the Pacific slope south of Oregon, and more or less eastward to the Rocky Mountains. In but few cases is this oak growth so dense as to be entitled to the designation of a forest; nor is the timber usually available for other purposes than firewood, the wood being brittle, gnarled, and of little durability. The supply of lumber for building and other purposes in the arts is therefore obtained either from the pine timber of the higher mountains or on the Pacific coast, from the rapidly diminishing redwood forests of the Coast Range northward of the Bay of Monterey, or finally from the forest regions of Oregon and Washington west of the Cascade Range. The hard woods for the purposes of the makers of wagons, agricultural implements, &c., are thus far brought from the Eastern States, via Cape Horn; although in the near future the woods of Mexico, now only available for ornamental purposes, will probably be brought into requisition. In the hands of the cabinet maker, the California laurel, and the maple, ash, and white cedar of Oregon, are common and highly valued materials.

CAUSES LIMITING TIMBER GROWTH.

While the rainfall is the ultimate controlling factor of forest growth, there is a proximate one which exerts a very material influence upon the actual distribution of forests and extent of forests in the arid region, viz., fire. While powerless for harm in the land of scattered oaks, where the undergrowth is rarely heavy enough to injure a tree by its combustion, it acquires fearful efficacy in the region of dense forests; and the destruction thus caused is far greater than in the region of summer rains, where any forest fire is likely to receive a severe set back, if not extinction, within a week or two. Where the rainless intervals extend to many months, there is nothing to check or circumscribe the progress of the destructive element save the exhaustion of the fuel or the intervention of a bare ridge or mountain chain. The fearful depletion of the timber resources thus incurred is graphically depicted on the map of Utah Territory accompanying the report of General Powell on the arid lands, where the "area destitute of timber on account of fires" is shown to be at least equal to that actually timbered, whether densely or scatteringly, while in the regions still used as hunting grounds by the Indians these fires are largely intentionally started for the purpose of driving game, though in part attributable to carelessness on the part of whites as well. The latter factor plays a conspicuous part in the country occupied more or less by settlers, where the neglected camp-fire and the discarded cigar stump, as well as the paper gun-wads of hunters, form prolific sources of mischief, against which even laws have been enacted with but little benefit. While the warm, dry, autumnal northers sweep over the redwood forests of California, whose value is so well and fully appreciated by all, the entire population is on the alert to check incipient fires, and yet conflagrations by which thousands of acres are swept in a few days annually redden the skies in September and October. The same occurs in the pine forests of the lower slopes of the Sierra Nevada. It seems as though nothing but severe penal legislation, even against carelessness, inducing a gradual change of habit through the force of public opinion, could be effectual against an evil which continually endangers property, and even life, within a few miles of the city of San Francisco. With a more dense population, such disasters as that which lately befell a part of Michigan would be of annual recurrence in the wooded portion of the arid region. The easy success of timber plantations in the prairies and plains between the Mississippi and the Rocky Mountains is proof conclusive that their treelessness is due, not to a climate unadapted to tree growth as such, but to a rainfall so light, or so distributed that, in the fight for existence against fires and strong winds combined, the trees could maintain themselves only in exceptionally favored localities.

In the regions of scattered oak timber, the undergrowth, whether herbaceous or shrubby (*chaparral*), rarely makes a fire sufficiently hot to kill the old trees; but it, as well as the ranging of cattle, is quite effectual in preventing the growth of another generation of oaks. Even where this is not the case, the exceedingly slow growth of the oaks of the arid regions would render the replacement of the original timber too slow a process even for the fuel requirements of a rural population. Already in some portions of the San Joaquin Valley cord wood has to be hauled from the foot-hills to distances of 20 and 30 miles. In the interior territories, where the need of fuel in winter is so much greater on account of the severe climate, the distance from which fuel must be brought (usually from the mountains) is one of the determining factors in the location of settlements, and many are on this account placed in much less desirable localities than would have been chosen in the absence of this consideration.

INFLUENCE OF FORESTS UPON ARIDITY.

Apart from the question of timber supply, the depletion of forests, whether by fire or by the ax, exerts a most injurious effect, in respect both to the amount and availability of the rainfall. While the former relation may be disputed by some who will not recognize any broad facts unless reducible to figures and instrumental readings, there can be no question as regards the latter. The bare surface allows the rain-water to shed, and the snow to slide and melt much more quickly and abundantly than in the case of a forest covering, where the trees mitigate the beating of the rain, and the mulch of their leaves, as well as their shade, keeps the soil loose and pervious, and enables an undergrowth to exist which could not resist the direct impact of the wind-driven rain, the dry northern and the hot summer sun. Instead of coming down in torrents which score the mountain side and carry off the soil, and then leave dry parched gulleys, the water that falls in the forest, whether as snow or rain, soaks down gently, partly into numerous small rivulets, partly into the ground, to reappear farther down, and, during the dry season, as springs. The effect of forests is, therefore, in all cases, to diminish the aridity of the surface, if not of the climate; though even the latter effect is reasonably predicable from changes wrought within historical times in the Mediterranean region of Europe and Asia.

A striking example of the local effects of trees in arid climates is found in the desert region of Africa, where the date palm supplies the chief means of existence. The utility of this tree is, of course, in a great measure a direct one, since it flourishes with a minimum of moisture and bears an abundance of nourishing fruit, but its utility does not end there; for it is in its shade alone that other useful plants, such as beans, melons, and other garden vegetables can be successfully grown, since the scorching rays of the noonday sun are thus mitigated. In extreme cases the tree is actually planted in pits as much as twelve feet in depth, from which it ultimately emerges with its crown only, forming a stout, short trunk quite unlike its usual habit.*

We have a somewhat parallel case in the mezquit of the southern arid region in Arizona, New Mexico, and Texas, where a small tuft only of leafy branches alone is seen above ground, while the main body of the tree is below the surface, so that the camper has to dig for his fire-wood. In the valley of California the new-comer is often surprised to find extensive wheat-fields retaining all or most of their natural growth of scattered oaks; and to note that grain grown in the shade is not only not inferior, but in some seasons even decidedly superior, to that grown in the open space. The shade, it is true, is not very dense; but such as it is it acts in dry seasons as does that of the date tree above alluded to, in protecting the grain from the too intense heat of the summer sun, and turning the balance in its favor in severe droughts. This non-interference is in a measure, no doubt, attributable to the fact that, in consequence of the long summer's drought, the food roots of these trees of the dry plains lie deeper than those of their eastern brethren. The importance of finding trees adapted to the several climatic regions of the arid territory, combining endurance and rapid growth with utility, not only for fire-wood but for the general purposes of civilized life, can hardly be overestimated. Among the native trees, the cottonwood holds the chief place thus far, at least in the interior territories. It fulfills best the condition of rapid growth as well as hardiness, but it requires so much moisture that it must needs occupy the very valley lands which are most eligible for cultivation; moreover, its soft wood is far from being very desirable even as fire-wood, on account of its rapid burning; hence it has in the more eastern portion of the treeless country been replaced by more desirable trees, such as the oaks, maples, and, of late, the catalpa. It is quite likely that some of these trees, now strangers to the interior territories, will, when planted under the care and protection of man, be found adapted to the needs of that country.

But the search for timber trees that will fulfill the conditions, and meet the needs of so important an interest in this great region, should not be left to private enterprise alone, but should receive the fostering care of the general and State governments. The introduction of the eucalyptus tree into Algeria bids fair to rescue from the desert portions of that country long abandoned for permanent habitation on account of their aridity; and there can no longer be any doubt that the bare treeless slopes, and even higher ridges, of the Coast Range of California, from San Francisco south, can be converted into a forest-covered country through the agency of the same hardy and rapid-growing tree. Like the cottonwood, its wood leaves something to be desired in the way of hardness and, apparently, durability, although the tests thus far made with the young timber can hardly be considered decisive; but even if it should do nothing more than yield easily and cheaply the supply of fire-wood, while at the same time favoring the retention of moisture, and of the surface soil, now so constantly being washed away, and increasing the number and available yield of springs, it would confer a great boon upon the coast. In a portion of the great valley, likewise, the eucalyptus grows without farther assistance after the first year, and can readily be made to serve the same purpose for which the prairie-dwellers in Louisiana have long adopted the "China" (or pride of India) tree (*Melia azedarach*) there. From eight to twelve acres of these trees, pollarded into a bare trunk each winter, furnish the fuel needed for a small household. The eucalyptus bears even more severe treatment than the China tree, and is at least as prolific of wood growth, while much more resistant of drought.

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* See "A monograph of the date palm," in Petermann's *Geogr. Mittheil., Erganzungsheft.*

RESULTS OF CULTURE OF THE EUCALYPTUS IN CALIFORNIA.

The subjoined statements in regard to the results of the growing of eucalyptus in California will be of general interest, as furnishing a measure of the profits to be derived from it, as compared with some of the ordinary field crops:

[Statements of Ellwood Cooper and J. L. Barker, Santa Barbara, January 7, 1882.]

Planted somewhat over 100 acres of *Eucalyptus globulus* and *E. rostrata* (*viminalis*,) with seedlings, 1872–'76, both inclusive, 6 and 8 feet apart, or about 1,000 per acre. One year's cultivation was given, but no irrigation. The trees are now (1882) from 40 to 80 feet high, the tallest 100 feet, with 2 feet diameter at 3 feet above ground. The average tree on the outside of the forest would make two railroad ties and one telegraph pole. No damage has been done by frosts or hot winds. The value of the land before planting was from $10 to $25 per acre; it is now worth from $100 to $400.

No one in the county besides ourselves has planted eucalyptus trees in forest form. In hedges and clumps there are in the county about 10,000 trees. Mr. Barker has 15,000. I have planted in clumps, hedges, and forests about 150,000, mostly blue gum and red gum (*E. globulus* and *E. rostrata*). I have, however, in all twenty-four varieties, nearly all of them doing well. The blue gum seems to grow more rapidly than the other varieties. The red gum (*E. rostrata*), however, is a good grower and will stand more drought than the blue gum. When they are so thick they do not grow so fast. Planting 6 by 7 feet, one acre will contain 1,000 trees. At six years the outside trees will give one-quarter cord of wood each. Planting 12 feet apart, many of the trees will give one-half to three-quarters of a cord. Lone trees with plenty of space, eight years old, will give one cord of wood. I have one tree 22 inches in diameter, 115 feet high, only eight years old; another, same age, over 2 feet in diameter, and 85 feet high.

[Statement of R. P. Thomas, Berkeley, Alameda County, January, 1882.]

Planted seven acres with seedlings of blue gum, sown in 1876; eight feet apart, or 680 to the acre. Cultivation was given the first year, but no irrigation. The average height of the trees at present is 60 feet, the maximum 100 feet, with 2½ feet girth at 3 feet above ground. No damage from frosts or hot northers. Each tree would now yield about one-fourth cord of wood; it is not good for railroad ties, but good timber for other uses when it can be kept dry. The value of the land before planting was $100 per acre; present value, $600.

I would state, in connection with the above, that, for planting the gum tree or eucalyptus, I would recommend particular attention to be given to deep and thorough cultivation before planting, and to plant only thrifty young trees. They should not be over 6 or 8 inches high, and should not be planted less than 16 feet apart. If planted closer, the trees will run up slender, and not make as much wood. My trees are planted altogether too thick, and I don't think thinning out would remedy the thing, unless it is done before the trees get much of a growth. Great care should be taken in the selection of the young plants. A stunted tree when young will always be a stunted tree. Thrifty, vigorous plants make a thrifty and vigorous,growth under all circumstances. Thorough cultivation should be given the first year, keeping the ground soft and all weeds down. There is no difficulty afterwards. Squirrels are a great pest in planting these trees, as they will cut off the young plants apparently for pleasure, or you might say to prevent an obstruction, as they prefer an open field. They do not eat the plants, but pass on, just biting them off apparently for mischief. It is next to impossible to destroy them, when all the surrounding fields are alive with them. I had great annoyance in this way, but obviated it, putting old coal-oil cans around the trees after cutting out both ends of the can. This seemed to frighten them off. The cans may be removed entirely after the first year. The cost of these tins is comparatively nothing. They can be found in abundance at any soap factory, where they have been used for packing tallow. I am now burning the wood of the blue gum in an open fire-place, and am astonished to see how well it burns green; in fact when burned green it is quite equal to most kinds of dry woods—giving a fire like unto hickory wood. I feel that the importance of this tree to California is not appreciated. It will in time clothe the surrounding hills with forests at great profit to the planter. I repeat that in planting the trees too much care cannot be given in preparing the ground. There should be no haste in planting; first get the land in condition, and when planted, guard against the squirrels, and you have no risk to take.

[Statement of Isaac Collins, Hayward's, Alameda County, January, 1882.]

In the winter of 1869-'70, J. T. Stratton planted 43 acres of *E. globulus* or blue gum, and two of *E. viminalis* or red gum; seedlings of same season, 8 by 8, or 680 to the acre. Cultivation given at first, but no irrigation. The trees are now from 80 to 100 feet high, the tallest 100 feet, and 2 feet in diameter 3 feet above the ground; some larger have been cut down. No damage has ever been done by frosts or northers. The past season 20 acres have been cleared; their yield was 600 cords of cord-wood, 130 of butts and roots. In 1876, the Central Pacific Railroad Company got 40 ties for trial, and the telegraph company bought 800 poles for trial. The wood has not proved durable for these uses.

Briefly, I may state that 20 acres of eucalyptus timber land was purchased one and one-half years ago by a party, price $210 per acre. He formed the plan of clearing it, and planting thereon a fruit orchard. He let out the contract of clearing off the eucalyptus to a party in Hayward's on the following basis: The contractors to pay $800; they to clear the land of the timber and stumps, plow it and prepare it for the trees, dig the holes for trees. For all that labor and money paid they received all the timber as their pay. The job has just been or is nearly completed, and they give me a statement of its yield, viz: Six hundred cords of wood and 130 cords of split stumps. The owner of the property seems inclined to doubt their statement. He appears to think the quantity much in excess of 600 cords. Before they commenced clearing, or after they had cut and corded a few trees, I estimated that it would give 800 cords, but taking their statement as correct the returns from the 20 acres from the beginning are wood cut previous to 1876, 14 cords; wood cut in 1876, 149 cords; wood cut in 1877, 100 cords; wood cut in 1881, 730 cords; total 983 cords, at $6 per cord, $5,898; 800 telegraph poles, 75 cents each $600; 40 railway ties, at 50 cents each, $20; total, $6,518, and to that amount add the $800, will give $7,318 in eleven years as the gross return. The same land if rented for farming purposes at $5 per year (20 acres at $5 per acre per year) would give during the term of eleven years, $1,100. From the sum of $7,318 would have to be deducted the cost of labor, raising the young trees, &c., as follows:

13,620 seedling trees, at $8, per 1,000	$108 96
Cost of planting, plowing, &c., at $3 per acre	60 00
For eleven year's cost of cultivating, &c., at $20 per acre	400 00
Total	568 96
Rental of land eleven years	1,100 00
Total cost of plantation	1,668 96

From the value of the wood, $6,518, deducting the labor, $1 per cord, gives $5,535; and taking from this $1,668.96, the cost of the plantation, there remains a clear profit of $3,866.04 on 20 acres of eucalyptus in eleven years, or an average of $17.20 per acre per annum, rent paid.

Similar results and estimates have been reported from other portions of the State as far south as San Diego.

All experience and reports agree that the blue gum, and some other eucalyptus at least, cannot be tolerated within 25 or 30 feet of anything else that is intended to flourish. It is a rank feeder and consumer of moisture; its roots will be found intermingled with those of other plants even at greater distances than above mentioned, when such plants have been heavily manured. It will dry up the surface soil with great rapidity and completeness, and will follow moisture forty feet away; at the same time it will find its own supply in the depths of the subsoil when necessary, and flourish apparently equally well. On account of this ravenous absorption of moisture alone it serves a valuable purpose in malarious districts, as has been abundantly proved in Italy. It is estimated that over five millions of these trees have already been planted in California. Experiments made at the State Agricultural College with the jarrah (*E. marginata*), whose wood is so highly valued in Australia, have shown it to be much more liable to damage by frost than other species; it can only succeed in the southern portion of the State. Its resistance to drought has not been tested as yet.

One point of the inconvenience in the planting of eucalyptus is that it fails to propagate itself adequately in the present climatic conditions of California. It bears seed abundantly, but apparently the latter does not find, as a rule, the proper conditions for germination. Eucalyptus forests, therefore, do not seem to spread, or to renew themselves from young growth spontaneously springing up. Whether these conditions will be permanently maintained, or whether in large forests the natural process of renewal by seeding would occur, is an open question.

Except with the aid of the hand of man, therefore, the eucalyptus will not sensibly encroach upon the treeless area. But it is probable that other trees, accustomed to the trying climate of the Australian interior, will perform this service. There are several acacias which rival the eucalyptus in endurance of drought and in rapidity of growth; and many of them seed fully, and after a few years surround themselves with a young growth of seedlings. Such are, among others, *Acacia floribunda*, *melanoxylon*, *mollissima*, and *lophantha*. The latter especially seems to be adapted to the part of forming outposts on the margin even of the sandy desert, shading the ground with its low spreading tops, mulching it with its leaves, and so forming the beginnings of a surface soil, and through its numerous seedlings advancing steadily into the arid plains. It is objected to on account of its being frequently infested with scale and aphides, and thus forming a breeding-place for these pests, from which they spread to orchards and gardens. But it might be made to perform its special functions remote from where such objections would be important.

Some of the Australian myrtaceous shrubs, such as *Leptospermum* and *Fabricia*, seem to be capable of playing a similar part.

OTHER TIMBER-TREES FOR THE ARID REGION.

Some data regarding other timber, shade, and ornamental trees, on trial in the grounds of the California College of Agriculture, are given in the following extracts from a report made by Mr. W. G. Klee, gardener in charge of these grounds:

> The collection of these includes a number of eastern deciduous trees, some of which are not planted nearly as much as they deserve, and others very little seen on this coast, so that little or nothing is known of their behavior outside of the experience of a few enterprising nurserymen.

EASTERN OAKS.

These, as a general thing, have been very slow. Out of seven different kinds none have attained a height of more than eighteen inches during two seasons, while the average height is about eight and twelve inches, the growth falling off in the same order as they are mentioned here: *Quercus imbricaria*, shingle oak; *Q. alba*, white oak; *Q. tinctoria*, *Quercitron*, or black oak; *Q. nigra*, blackjack oak; *Q. coccinea*, scarlet oak; *Q. phellos*, willow oak, and *Q. Catesbaei*, barrens scrub oak.

Unfortunately, the most valuable of these, the white oak, failed partly, like several others. in germinating, the seed being badly worm-eaten, hence but a small number was raised.

Seeds of these and others missing are, however, now ordered again, and the collection will, doubtless, by next year, contain nearly all the North American oaks. It is a matter of surprise to see how different from all the mentioned list of oaks, the north European, or, as it is variously termed, the German or the English oak (*Quercus robur*), has behaved, which was planted at the same time as the rest.

Out of twenty trees measured none is less than 20 inches, and a number 3 feet high, thus surpassing the other two and three times in height, besides having strong side branches. As this tree has, from Australia, the reputation of being able to resist the fiery winds of the desert, there are good reasons for giving this valuable tree a trial in our interior counties, where wind-breaks and wood are badly needed; but it would be most advisable to plant the acorns in the fall of the year, on the spot where the tree is wanted to remain, as the tap-root formed penetrates very often three and four feet the first season. If, however, this is impracticable, there is no danger in transplanting the young trees after the first year's growth is ended; but it should be done then, or it is apt to become a rather risky business. Our trees here were transplanted the first year, and though on an average two-thirds of the tap-root was cut off, not a single tree went back.

The eastern wild cherry (*Cerasus serotina*) is a beautiful and fast-growing tree that deserves a place in any good-sized garden, and as an avenue and timber tree might be planted advantageously, as it furnishes very valuable wood for the cabinet-maker: its growth here in two years from seed is about 4 feet.

The eastern box-elder (*Negundo aceroides*) has here borne out its reputation as one of its fastest-growing, hardy, deciduous trees, and as such certainly deserves to be planted or tried in our interior counties, where the eucalyptus fails on account of the severe winter. Trees two years old from the seed are now from 3 to 5 feet 4 inches high. *Kœlreuteria paniculata* is also a rapid-growing and highly ornamental little tree, of Chinese extraction; it is termed bladder-nut tree on account of the fruit, *Carya porcina* (pig nut), *Carya tomentosa* (mockernut). Two species of hickories, have been tried, but have shown themselves to be extremely slow growers, having only reached 6 to 8 inches in height. Though valueless for their nut, these two species furnish good wood, and are being tried with that view; it must, however, be remembered that most of these decidedly tap-rooted trees require a long time for establishing themselves, and the first two years are generally spent in this manner.

Of the Japanese trees raised from seeds distributed by the Agricultural Department at Washington, the deciduous ones have made a fair growth; especially is this the case with two elm-like trees, *Planera cuspidata* and *Homoiocellis*, which both average about 4 feet in height, started in February from the seed. *Planera* is a drooping tree. *Horenia dulcis*, a tree of the buckthorn family, recommended as a hedge plant, is also a fair grower; few plants, however, have been raised from the seed.

Firmiana platanifolia is a striking sterculiaceous tree, with large, sycamore-shaped leaves, on very long stalk; it resembles the *Paulowina* in habit of growth, but unlike that, the first year is a slow grower; no specimen is above 10 inches; seed started in February. Grows fairly the second year; deciduous here, but otherwise hardy. Is quite an acquisition, at least to our ornamental trees.

Argania sideroxylon is a North African tree, said to produce fruit used as food for cattle; the wood exceedingly hard. It is perfectly hardy at Berkeley, but a slow grower thus far.

Camphora officinalis (the Japan camphor tree) promises remarkably well. It has been grown from seed with ease, and has partially been propagated with cuttings from woody branches. It is to be recommended for trial on a large scale in the moister coast region (red-wood lands). It has proved hardy in Berkeley, only the extreme growing ends being slightly nipped by severer frosts; grows very rapidly.

The evergreens, pines, spruces, and retinospora, received from the same source, are all very slow, and it is almost impossible to give any judgment in regard to their growth. A retinospora species is the most promising now. It should be mentioned that all these trees, timber and ornamental, have been grown together in a nursery located by a creek, which, however, is very low at all seasons, and nearly dry for three months of the year. The soil is a heavy loam, and was not in near as good a condition as desirable when planting was necessary. On the whole, all the trees have been sparingly irrigated; the small evergreens every three or four weeks, from July to October; the larger trees, as the American oaks, hickories, and Japanese deciduous trees, three times during the season, the English oak, *Kœlreuteria*, and wild cherry only once, in August, and box-elder not at all. While it may be urged that seepage has helped the unirrigated trees, there is very little probability of this having taken place to any great degree, the soil being too tenacious to allow this to occur; and, on the whole, it is my opinion that the growth of these trees would be far greater on good, porous bottom-land entirely without irrigation, which probably has been the experience of others.

It should be added that during the succeeding year (1881) the conclusions here foreshadowed have generally been sustained. The remarkable growth of the European oak has continued to outstrip beyond all comparison that of its American relatives, so that it may probably be used advantageously not only in the replacement of the slow-growing Californian oaks, but perhaps even as a vanguard for the advance of forests into the treeless region. Considering its native climate, this is certainly a remarkable result, which should encourage us in the prosecution of further experiments in the search for trees that will maintain themselves in the arid climates, and if possible will continue to encroach upon the treeless area unaided by man save in the way of protection from fire. Australia seems thus far to offer the most promising field for further acquisitions in this direction, but the arid regions of Africa and Asia will also doubtless furnish useful material, especially for San Diego and Western Arizona. The useful palms of Africa and Arabia might be made to take the place of the handsome but unproductive native species; the date palm particularly would doubtless find a congenial home alongside of the *Pitahaya*, or tree cactus, of Arizona. For the interior plateaus, useful precedents can be found in the plateau country of Asia, now rendered so much more accessible to research. Private enterprise, however, is quite inadequate to the accomplishment of these objects, which seem to belong peculiarly to the province of the United States Department of Agriculture.

IRRIGATION OF THE ARID REGION.

The subject of irrigation in the Arid Region has been treated so ably and fully in its general aspects in the report of General J. W. Powell, that a summary of his conclusions, with a few comments, is doubtless the best mode of presenting the main points here.

The lower limit of successful agriculture without irrigation is set by him at an annual rainfall of twenty inches, success at and even above that limit depending essentially, however, upon the mode of distribution of the rains through the year. The general limit of the region so circumstanced to the east is near the 100th meridian, running from about Brownsville, Tex., to a point 50 miles west of Pembina; it extends thence to the Sierra Nevada, and in California to the Pacific coast.

In the warmer portions of the region a larger additional supply of water is requisite to insure crops, the evaporation being greater. Again, the portions of lands lying near, and especially to westward of high mountains, are agriculturally favored by a participation in the greater precipitation due the condensation of moisture by such mountains.

On the mountains and high plateaus forests are found at elevations so great that summer frosts forbid the cultivation of the soil. Here are the natural timber lands of the Arid Region, an upper region set apart by nature for the growth of timber necessary to the mining, manufacturing, and agricultural industries of the country. Between the low, irrigable lands and the elevated forest lands there are valleys, mesas, hills, and mountain slopes bearing grass of greater or less value for pasturage.

As regards the amount of flowing water available for irrigation, the conclusion is that it is in general sufficient for only a small proportion of the lowlands—in Utah, for example, only about 2,262 square miles out of 80,000, or 2.8 per cent. The amount of water available for irrigation can be increased by winter storage, to an extent depending greatly upon local circumstances. Storage in the lowlands is wasteful on account of the great evaporation during the warm season.

Irrigation on a large scale, whether by storage or the diversion of larger streams, requires large capital and co-operative action; and in order to prevent forestalling, waste, and conflicts of rights, general laws regulating the appropriation and use of water in the Arid Region are necessary, and should be enacted as soon as possible. The pre-emption, homestead, timber-culture, and desert-land privileges are adequate for actual settlers on irrigable lands dependent on minor streams, but are insufficient for the settlement of the irrigable lands that depend on the larger streams, and also for the pasturage and timber lands, than is contemplated in either of the above privileges. A pasture farm requires not only a large area of land, but also a certain amount of accessible water supply. A "water front" of adequate supply should then be alloted to each pasturage tract as an inherent right, water-rights going with land titles, the latter being valueless without the former.

These are the main points made in reference to irrigation in the Arid Region by General Powell. While written, perhaps, more with a view to the yet unsettled regions of the interior, they embody essentially also the needs of the irrigation districts of California, as demonstrated by the actual experience of thirty years. In the conflicts that have arisen in consequence of the absence of the legislation suggested by General Powell, one point has been prominently brought out, to-wit, the irrepressible conflict between the provisions of the common law on the subject of riparian rights and the requirements of agriculture in a region requiring irrigation. The declaration of the former, that every riparian owner is entitled to the undiminished volume of the stream (intended evidently for the safe guarding of the interests of the uses of water-power) strikes at the very foundation of the use of water for irrigation purposes, and is thoroughly incompatible with such use, and, therefore, with the very existence of agriculture in the Arid Region. Yet, this law has been invoked again and again in California by riparian owners claiming the undiminished volume of the streams from those above them, while fully intending to use it freely on their own lands. Numerous costly and protracted lawsuits have been and are now pending in the courts of the State, which are embarrassed by the conflict of the acknowledged foundation of American civil law with the manifest equities of the cases before them. In one test case, at least, the lower court decided that the common-law doctrine does not apply to irrigation regions; but, while this is the common-sense point of view, it is doubtful whether the higher courts can, in the present condition of the code, sustain it. It is certainly of the most vital importance that this matter should be so settled by Congressional action in the Territories that similar conflicts cannot arise when, with the advance of the Territories to the dignity of States, the subject passes beyond the control of the general government. Again, the forestalling, by means of the pre-emption, homestead, or timber privileges, of all the water-supply from springs available during the dry season, has, in California, created a situation in which many such pre-emptors of the 150 acres are, as a matter of fact, "lords of all they survey," since no one can occupy the adjacent lands without paying them tribute for water-supply; and this still is more emphatically true of owners of large tracts, Spanish and Mexican grants, &c., which were usually selected originally because commanding water-supply.

The control of water now used in irrigation ditches in California is almost altogether based upon the right of "prior appropriation" in pursuance of custom rather than law; a method not without its merits in respect to the promotion of irrigation enterprises, but liable to gross abuse in forestalling, since it places it within the power of the appropriator to carry the water to lands in which he is interested, to the detriment even of riparian owners, who, under the common law, are entitled only to so much water as they require for household and stock, but not for irrigation. It is needless to dwell upon the gross injustice and oppression which the principle of prior appropriation may work in its application when and where water is scarce, and upon the extent to which it is contrary to sound public policy to let such important privileges "lie around loose," to be picked up by whosoever can do so by virtue of the control of capital.

It is difficult to foresee how the many claims or rights acquired under this system in California can now be adjusted in accordance with the public interest, without a severe wrenching of what it is usual to consider "vested rights." It will obviously become necessary to resort to the State's ultimate right of eminent domain, in condemning the water available for irrigation to public use, under such regulations as will inure to the greatest good of the greatest number. But this fact emphasizes so much the more the pressing need of avoiding similar complications in the future, in the regions still subject to the control of the general government, by timely legislation definitely regulating the rights and uses of water in the Arid Region; not only with reference to that applicable to irrigation, but also with respect to pasturage lands as above noted. Provisions substantially covering the points embraced in the drafts of two acts contained in General Powell's report should become general laws as soon as possible. In framing these measures it should not be forgotten that irrigated land is very much more valuable and productive than that which is dependent upon the accidents of the seasons; not only because of its exemption from the risks and failures involved in the cultivation of unirrigated land even in the "humid" portions of the world, but also because of the important part taken by the solids dissolved or suspended in the irrigation water in increasing and maintaining the fertility of the soil. The irrigator is exempted from the necessity of supplying manure to restore the soil ingredients withdrawn by his crops, to an extent varying in different localities, but always taking the form of a very tangible balance in his favor, in some cases (as in that of the valley of the Nile for ages past) amounting to a complete relief from all consideration of the question of the maintenance of fertility which is intruding itself more and more urgently into the calculations of American farmers, and threateningly confronts every tiller of the soil in the Old World.

These considerations justify the adoption of a much smaller unit for the farm in irrigation districts; the more complete and systematic utilization of the soil's powers enabling a smaller area to subserve the needs of a family. The unit of 80 acres, instead of the usual 160 suggested by General Powell, is certainly amply large in soils of any reasonably adequate native fertility.

In these points of view may also be found a partial answer to the question, often asked, what inducement there is for the settler to occupy the regions laboring under so many natural disadvantages when so much fertile land remains unoccupied in more favored regions? From an abstract point of view, the question seems difficult to answer; but concretely, the explanation lies in the fact that human nature will take risks where there is a reasonable chance of success, as is the case in humid climates; whereas in the arid regions, success being impossible without irrigation, but becoming a certainty with it, farming becomes a much more safe, satisfactory, and paying occupation. If, on the other hand, we inquire why it is that the abundant water supply of the humid regions is not utilized with the same view of reducing the success of crops to a certainty, instead of risking the disastrous failures that afflict them from time to time in the occurrence of droughts, we can but point to that same principle of human nature which renders gambling so dangerously attractive, and drives the "prospector" to continue in the search for new mines rather than to settle down to the working of those he has already discovered.

Aside, however, from these considerations, the treelessness of irrigation countries is in itself not a slight advantage to the settler of small means, since it relieves him from the necessity of incurring the great expense and delay of "making a clearing," an operation often involving, in humid climates, an expenditure altogether out of proportion with the productive value of the land. In the great valley of California, as in the prairies of the West, the plow can be put into the land without any preliminaries; but there is no heavy sod necessitating the use of correspondingly heavy draft, the first plowing being nearly as easy as the later ones.

In climates having a long growing season so far as temperature is concerned, the effects of irrigation on actual production are almost startling. Thus, in the southern part of California, as well as in Western Arizona, crops may be started at whatever season suits the convenience of the grower, except two in the year; and this holds true for market gardens as far north as San Francisco, where vegetables of nearly all kinds can be had in the market almost throughout the year. In Tulare and Kern Counties, five cuts of alfalfa have been taken off the same field in a single season, and ten tons of its hay made. So with sorghum, Egyptian corn, and pearl millet, when cut for forage, of which, with irrigation, three heavy cuts have been made, an enormous yield, which of course could be maintained only on a very strong soil, or later by the aid of manure. But irrigation enables the farmer to impart to the penny a nimbleness unheard of in regions dependent upon the seasons alone. The investment of a certain amount of money in land and manure can be "turned over" twice in the season, or even oftener, in a region of long summers. There is no reason why the same could not be done in the Southern States; but, as a matter of fact, it *is* done only where irrigation is compulsory.

IRRIGATION IN CALIFORNIA.

The commanding importance of the subject of irrigation in the State of California has repeatedly secured for it legislative attention, but no general measures toward ascertaining the resources of the State in lands and waters adapted to irrigation were taken prior to the year 1878, when an act was passed providing for the appointment of a State engineer, whose duties were defined to be, "under the direction of the governor, to investigate the problems of the irrigation of the plains, the condition and capacity of the great drainage lines of the State, and the improvement of the navigation of rivers." A succeeding portion of the act imposes the duty of inquiring into and reporting upon "the question of the flow of *débris* from the hydraulic mines into the streams, and the injury to agricultural lands by the flow of *débris* thereon."

Between 1878 and 1880 the work on both of these important branches of inquiry was actually prosecuted under the able direction of Mr. William Hammond Hall, as State engineer; and in January, 1880, he submitted to the legislature, then in session, his first report, an able, thorough, and highly important document. It gives succinctly and systematically the main facts regarding irrigation in other countries, as well as in California, compares and discusses the differences of climate, soil, and agricultural practice in the irrigated regions of the world, as well as in different portions of California; also the legal aspects of the question of water-supply, and the difficulties which in California, as well as elsewhere, have arisen from a failure to place the whole matter, from the outset, upon equitable and distinctly defined basis. Drafts of bills to be passed by the legislature, tending to remedy existing defects and forestalling their recurrence hereafter as far as practicable, are also given. Numerous tables showing the area of watershed, measurements of supply, both in streams and ditches, area irrigated, areas capable of irrigation, &c., attest the diligence and good jugdment with which the work was conducted. Most of the numerical data hereinafter given are taken from this report, which deserves to be more widely known. Unfortunately, the agitation in regard to the mining *débris* question, which has increasingly irritated the public mind ever since the passage of the act providing for the building of dams to impound the tailings of the hydraulic mines, has overshadowed the irrigation problem for the past two years, and caused such a curtailment of the appropriation available for that branch of the work, that the report made to the legislative session of 1881 contains but few additional data relating thereto, while reiterating the recommendations previously made in regard to the establishment of a consistent and equitable system of water-rights, the need of which is doubly emphasized by the many law suits involving such rights that have vexed the courts for several years past.

IRRIGABLE LANDS OF CALIFORNIA.

The main irrigable area in the State is the great Interior Valley, embracing altogether about 30,000 square miles. Of this area, about 11,300 square miles belong to the San Joaquin Valley, from the Cosumnes River to the Tejon Mountains; a maximum length of 260 miles, by from 30 to 70 miles in width. It is here, as well as in the southern region (Los Angeles, San Bernardino, and San Diego), that the irrigation question assumes the character of a vital problem, a *conditio sine qua non.* In the Sacramento Valley, irrigation is but little resorted to on the east side of the river, where, on the contrary, the mining *débris* problem agitates the public mind, and mining ditches furnish the supply of irrigation water chiefly to the foothill lands and mountain plateaus; while on the west side, in the counties of Yolo, Solano, and Colusa, irrigation is again prominent, though not so vital as in the San Joaquin Valley, on account of the greater annual rainfall. Irrigation in the San Joaquin Valley is thus far practically confined to the portion lying east of the trough, and traversed by the rivers issuing from the Sierra Nevada. The total of the dry plain lands of this "east side" embraces an area of 7,687 square miles, of which about 69 per cent. may be assumed to be irrigable from the current water-supply of the streams. Since the trough of the valley lies much nearer the Coast Range, in fact touching the foothills at Buena Vista slough, in Kern County, the area of the "west side" is very much smaller, viz., about 2,689 square miles.

> All south of Tulare Lake, and a large portion north of the lake, on the west side, may be classed as non-irrigable land, not only on account of the absence of a sufficient water-supply, but by reason of the general unfitness of the soil for cultivation by irrigation. The sources of supply for irrigation are Tulare Lake, the San Joaquin River, and the small streams of the Coast Range.

I remark, in reference to this statement of Mr. Hall, that, as I have shown by the analysis of its waters, Tulare Lake is altogether unfit, either as a source or even as reservoir of irrigation waters, on account of its alkalinity, as stated more in detail below. The small intermittent creeks flowing from the Coast Range are but little to be relied upon in this connection, the more as the porosity of the formations in that region renders storage very precarious. Supposing King's and the San Joaquin River to be the only available sources of supply, the irrigable lands of the west side would, according to Mr. Hall, be about 718 square miles, or 460,000 acres, making the grand total of lands, irrigable from sources adjacent to the plain of the San Joaquin Valley (exclusive of storage in higher reservoirs), about 6,000 square miles, or 3,840,000 acres. Of this vast area of highly productive soils, only about 188,000 acres, or about 5 per cent., are estimated as being at present under irrigation.

Artesian water is to a limited extent already used for irrigation in the San Joaquin Valley. In a few cases saline and alkaline waters have been obtained from the wells, but a considerable number have water that is no more objectionable than that of Kern River at least. Of late such wells yielding abundant streams have been obtained in Tulare County, in a region much troubled with alkali, which they will help to subdue. The possibilities of the valley in this respect have hardly yet been approximately ascertained, as it is very important they should be.

In the Sacramento Valley the lands irrigated from Cachè Creek aggregate to about 13,400 acres. There are no data for estimating the other irrigated lands of the plain, but the amount of irrigated land in the foot-hills of the Sierra (chiefly opposite the central portion of the Great Valley) may be taken at about 9,000 acres.

With the exception of Cachè and Putah Creeks, on the west side of the Sacramento Valley, no important amount of irrigation water can be derived from the Coast Range, except through winter storage, which has not thus far been practiced. To seaward of the Coast Range small tracts of irrigated land are found from San Francisco southward, but they form the exception northward of Santa Barbara. In the Salinas Valley it is not convenient, from the small volume of the river and the lack of tributaries, and fair crops are made without it. Farther south it is more or less practiced in many of the seaward valleys, very generally so in that of Santa Barbara, and thence soutward increasingly, until in the Los Angeles region the maximum proportion of irrigated lands is reached, the total in the counties of Los Angeles and San Bernardino reaching nearly 85,000 acres, and but little land being cultivatable without them.

SOILS OF THE ARID REGION.

The first impression produced upon the explorers of Western plains and plateau lands, treeless, and at certain seasons almost bare of any of the familiar vegetable covering of the surface, was, that the soil was naturally sterile, and ever would be, the more so as at many points nature seemed to have done what Attila threatened to inflict on all communities that should attempt to resist his advance, "sowing salt," so that nothing should grow there for evermore. Thus the "Great Western Deserts" came to be proverbial, and many were the regrets that nature should have destined one-half of the territory of the United States to remain a howling waste.

The general recognition of the fact that water alone is wanting to render these deserts productive of whatever crops their climatic position will permit is of comparatively recent date, although this view was long before held and asserted by meteorologists. The results produced by irrigation in Colorado and Utah have now rendered this a familiar truth; and while it is true that in a climate of deficient rainfall the process of soil formation, as well as the soils themselves, differ in some respects from those familiar to us in the regions of summer rains and abundant vegetation, yet the advent of the life-giving water, with judicious agricultural treatment, soon does away with all that would interfere with profitable culture.

But little has so far been done in the systematic investigation of the soils of the arid regions* outside of California; but what has been done seems to show that the majority of the soils of the Arid Region possess certain advantages of chemical composition over those, *e. g.*, of the southern portion or the Alleghany Range. Chief among these are a remarkably high percentage of potash and a large proportion of lime. This difference is rather, perhaps, to be accounted for as one of the effects of the arid climate than as the result of a fundamental difference in the composition of the rock materials that have contributed to their formation. This will be appreciated when it is considered that these soils have for ages been subject to a most thorough system of summer-fallowing, unaccompanied by the leaching process, which is inseparable from an abundant rainfall, and which is particularly effective in depleting soils of lime, the especial promoter of thriftiness in production.

In the examination of the soils of California, carried on partly under the auspices of the tenth census, and continuing under those of the State College of Agriculture, these peculiarities are strikingly shown. The lime percentages of the soils of Middle and Southern California are on an average from four to eight times as high as in the soils of the Carolinas and Georgia; while the potash percentages are quite commonly as high as those found only in the richest soils of the Mississippi bottom. The phosphates also range higher on an average, though not to a similar extent, as lime and potash. On the other hand, the humus content of these soils is usually low, a natural result of the great facilities offered to oxidation by the dry condition in which the soils normally exist. A general description of the prominent soil features of California is here given, as illustrative of what occurs, more or less, throughout the Arid Region; especially so as regards the important feature of the "alkali soils," which, as will be seen, so far from being especially sterile, are in some cases simply permeated by an excess of mineral plant-food, and therefore of high intrinsic or virtual fertility.

SOILS OF CALIFORNIA.

While it would be impossible to give, in any brief space, a detailed account of the great variety of soils occuring within the wide area of the

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* I must on this point differ with General Powell, Director of the United States Geological Survey, who, in his able report of the lands of the Arid Region, remarks that "too much attention has been paid to the chemical composition of soils," &c., So far as I am aware, we are in a condition of dense ignorance as regards the composition of the soils of the entire region between the Rocky Mountains and the Sierra Nevada.

State of California, only a few of which have as yet received any close examination, some general statements may be made to show the high value of some of the apparently most arid lands, when subjected to the life-giving influence of irrigation.

As regards, first, the Great Valley, the two climatic divisions defined above are maintained also, measurably, as concerns the soils. Broadly speaking, it may be said that in the northern division (the Sacramento Valley) the soils are prevalently loams, more or less heavy, largely interspersed with tracts of heavy clay or "adobe" soils, often the exact counterpart of the "prairie" soils of the Mississippi Valley; while in the southern portion, or San Joaquin Valley, the bulk of the soil is altogether prevalently sandy, occasionally to the extent of rendering them sterile; and what is there called "adobe," by way of contrast, would mostly be elsewhere considered a moderately clayey loam. As to intrinsic fertility, it would be difficult to decide between the two divisions; for while the heavier soils, other things being equal, are usually the richer in plant-food, and therefore the more durable, the great depth of the light soils of the San Joaquin Valley seems to compensate in a measure for the somewhat inferior percentage of plant-food. This is the more true, as the "sand" is to a considerable extent not simply siliceous, but consists largely of comminuted granitic and eruptive rocks, with an admixture of the ancient slates, or rather schists, which cover the flanks of the Sierra and constitute the proverbial "bed rock." Moreover, the "foot-hills" are commonly bordered, on the valley side, by a rolling plateau land, underlaid by the marly strata of the Tertiary formation; and these, commingling with the materials brought from the higher lands, from naturally marled soils, whose thriftiness when under irrigation contrasts strikingly with their barren aspect during all but the winter and early spring months, so long as they remain in their natural condition.

From Redding, at the head of the Sacramento Valley, to Bakersfield, at that of the San Joaquin, the valley has along its eastern border a belt of upland, varying in width from one to twenty miles, and from fifty to twenty feet above the natural drainage level, the soil of which is a yellow or reddish loam of varying character, evidently formed by an intermixture of the red soil of the foot-hills with the valley deposits. Much of this land, which is mostly too high to be reached by the present irrigation canals, has a singular hillocky surface, known as "hog wallows" doubtless the result of aqueous erosion in past periods. These "hog-wallow" lands differ essentially both in their character and origin from those similarly named in Texas and other Gulf States (which are mostly heavy prairie soils), and even as far south as Merced County produce excellent cereal crops, as well as fruits, without irrigation.

On the western or Coast Range side of the valley the soils are usually materially different. The Coast Range consists in the main of gray tertiary and cretaceous materials, prevalently clayey northward of San Francisco Bay, but growing more and more sandy, on the whole, in a southward direction. Hence, we find extensive tracts of very stiff "adobe" soils of very variable degrees of fertility on the western side of the Sacramento Valley, and as far south as the southern line of San Joaquin County, where the widely gaping cracks of the adobe, during the dry season, attract the attention of even the casual passer-by. Southward, the soils lying at the foot of the Coast Range become increasingly sandy, as do the bordering hills, until in the region opposite Tulare Lake it is reported to be a "sandy desert." This statement may require to be taken with a considerable grain of allowance, since in the absence of any opportunity for irrigation, and of any serious attempts at settlement thus far, the capabilities of the region can hardly be said to have been fairly tested.

The soils of the western border of the Sacramento Valley are at many points materially and most beneficially modified by the admixture of materials contributed by the tributary valleys heading within the region of eruptive or volcanic rocks, whose southern portion has become noted for the high quality of the wines produced in the valleys of Sonoma and Napa. These soils are also originally red, as is still the case on the mountain sides and higher benches of the valleys; and while less suited to cereal culture, they seem to be pre-eminently adapted to the perfecting of the higher qualities of fruits.

The orchard products of Vacaville, widely known for their excellence, are grown on such soils; and the fruit-growing region of Solano and Yolo Counties, the present center of the raisin industry, is covered by the joint deposits of the Sacramento River and Putah Creek, the latter one of the main drains of the volcanic region.

Soils quite similar to these, both in origin and productive qualities, exist on the opposite side of the valley, where the Tuolumne, Mokelumne, and Cosumnes Rivers traverse the volcanic tufas that cover the gold-bearing gravels of Table Mountain. As regards their general chemical character, the soils of the entire valley (of which quite a number have been analyzed, partly under the direction of the State Agricultural College, partly under those of the Census Office), are throughout remarkable for a high percentage of lime, which rarely falls below four-tenths of one per cent., and most commonly ranges from one-half to one and a quarter per cent. This circumstance explains, in a measure, the high thriftiness of these soils, allowing the rapid development and generous fruiting which accompanies the minimum allowance of moisture, and maintains the farmer's hopes that the success of a single season will suffice to wipe out the financial failures of two or three dry seasons. A generous allowance of potash accompanies the lime even in the very sandy soils of the Tulare Plains, mostly exceeding four-tenths, and ranging as high as one and a quarter per cent. The phosphates are on the whole low in the sandier soils of the San Joaquin Valley, but high in the adobe soils of both divisions.

The red soils of the foothills have already been mentioned. The character of the foothills of the Sierra Nevada throughout its course along the Great Valley, varying from a moderately clayey loam (as in the placer region of Eldorado and Placer Counties) to a heavy, though not uncommonly gravelly, is an orange-red clay. This character seems to be sensibly the same, whether the soil be derived from the decomposition of the ancient slate "bed rock" or directly from the granitic rocks; thus creating a presumption that the two rocks are closely related.

Where the foothill soils either obtain a sufficiency of moisture naturally, or can be irrigated, they prove abundantly productive, and are rapidly acquiring a special reputation for the excellence of their fruit product, both of orchards and vineyards. While at present it is in the main a region of spring pastures, it is doubtless destined to be in the future one of small farms producing products of high value. The soils are highly charged with iron (ferric hydrate or rust) to the extent of from 7 to over 12 per cent.; which being finely divided, imparts to them the intense orange-red tint so familiar in the region of the placer mines, and during the dry season manifesting itself in the equally familiar red dust that disguises the natural tints even on the trees themselves. The soils of the foothills, so far as they have been analyzed, agree with the soils of the valley in having a high percentage of lime, from about one-third to one and a half per cent., while the supply of potash and phosphates, as well as of organic matter, is smaller, and sometimes low, though never, apparently, inadequate for present productiveness, in the presence of so much lime.

The soils of the Coast Range vary greatly in the different portions of that broad belt of hilly land. In the middle portion, more or less directly related to the Bay of San Francisco, the "adobe" character is prevalent, not only in the valleys, but even on the summits of its rounded ridges, where in favorable seasons the yields of grain may be as high as in the valleys themselves. The soil is usually many feet in depth, with only here and there a rocky knoll projecting through it; cracks wide open in summer, and when the rains come somewhat abruptly and violently, the water, descending quickly to the underlying bed-rock, gives rise to innumerable land slides, sometimes of considerable extent, and of vital importance to land owners. In the valleys intersecting such regions, and notably along the border of San Francisco Bay, there lie highly fertile tracts of "black adobe," or black prairie soil, sometimes so stiff and waxy as to be difficult to till, but under good treatment and in favorable seasons profusely productive. The adobe tracts are intersected, at right angles to the bay, by the belts of lighter sediment brought down by the present streams. In the country lying northward of the bay, the soils formed by the eruptive and volcanic rocks assume increased importance, and constitute the leading feature of the grape-growing region of Sonoma, Napa, Solano, and Yolo Counties, as well as, farther north, in Lake and adjoining portions of Colusa and Mendocino. Here the lower portions of the mountain sides are frequently constituted of the heavy tertiary and cretaceous materials which form adobe, while the upper portion consists of igneous rocks yielding lighter soils, often deeply colored with iron, and more especially adapted to fruit culture. The valley soils are of course a mixture of both, and it is on such composite soils that the enormous yields of from twelve to fourteen tons of grapes per acre are sometimes obtained.

Of the soils of the mountainous regions of Mendocino and the country northward to the Oregon line, but few data have thus far been obtained. Specimens of valley soils, and especially of that of Eel River, in Humboldt County, seem to show a great similarity to those of the coast valleys south of San Francisco Bay. It is a gray silt with very little coarse sand, many feet in depth, with high percentages of potash and phosphates, but deficient in lime, and probably from that cause difficult to till, and somewhat unthrifty after continued cultivation. Southward of San Francisco Bay, where with otherwise similar composition the lime percentage is large, this inconvenience is not observed, and these silty valley soils are remarkable for their retention of moisture near the surface throughout the dry season—a highly valuable property in the dry climate. "Adobe" soils are exceptional in the southern Coast Range region, gray loams or silts, or sometimes sandy soils being on the whole predominant in the uplands also. In the "semi-tropic" region of Los Angeles, San Bernardino, and San Diego, the uplands or "mesas" which occupy the larger portion of the surface have usually a reddish, gravelly loam soil, more or less heavy in different localities, but on the whole remarkably uniform in its character. It seems to be a modification of the "foothills" soils northward of the Sierra San Fernando, but of greater depth, more easily tilled, and with higher percentages of plant food, especially of phosphates. Hence, though of the disconsolately arid aspect of a gravel bed in the dry season, these mesa lands when irrigated prove profusely fertile, and in spring are covered with a dense carpet of bright flowers. For fruits adapted to the climate, they are probably excelled by few so far as quality is concerned; although, on account of greater facility for irrigation, the lower levels and the terraces or benches along the streams have chiefly been occupied.

The soils of the Colorado River bottom is a light, pale-colored loam of great depth, highly calcareous, with over one per cent. of potash, but a comparatively low amount of phosphates for a river bottom. It proves extremely fertile where cultivated.

The soils of the Mojave and Colorado Deserts have received but little attention and examination thus far. While a portion of the surface is covered simply with drifting sand underlaid by rock or hard-pan, there are in the Mojave Desert, at least, extensive tracts possessing a soil of fine gray silt, on which the yucca tree attains a luxuriant development; while others are covered with low but dense growth of hardy shrubs, and grass enough to render the spring pasture valuable and nutritious, while the sheep crop the leaves of shrubs later in the season. Plainly, a large portion of this desolate-looking country evidently reawaits only the life-giving influence of water to be at least available for stock-raising, and to no inconsiderable extent for cultivation also. The lower portions of the Colorado Desert especially are so severely afflicted with alkali of a corrosive character that, being incapable of drainage on account of being below the sea level, their reclamation seems hopeless.

TULE LANDS.

This is the name applied in California to all lands, whether littoral or inland, bearing as an important ingredient of its vegetation the tule or rush which, of course, varies in kind according to location near to or remote from saline tide-water. In the coast marshes the tule is prevalently the rush, properly so called (*scirpus lacustris*); while the fresh-water marshes in the upper portion of the delta of the Sacramento and San Joaquin, as well as in the upper portions of the courses of these rivers, consist largely of other species, notably the cat-tail rush (*typha*). All these lands are, of course, subject to overflow, and need protection by levees.

The surface of the marsh lands is covered with a matted mass of roots from one to several feet in depth, in all stages of decay; the lower portion being in a peaty condition, and sometimes available for the manufacture of peat. Occasionally this mass is afloat, so as to rise and fall more or less with the water; in most cases, however, a solid sediment soil of high productiveness underlies the roots at a moderate depth. It is customary to set the latter on fire during the dry season, when they gradually burn down to the soil, enriching the latter with its ash. Into the ash grain-crops are sown, often yielding enormous returns, especially on the islands of the delta above Suisun Bay. The largest body of tule lands lies to northward of that bay. Irrigation is, of course, unnecessary in most of these naturally moist lands, where cattle find abundant pasture throughout the dry season, even when they remain in their natural condition, and still better where pasture grasses have been introduced; they are therefore at first a natural stock-raising region.

The prevalently bold and rocky coast of California and Oregon presents but few and small marsh areas outside of the Great Valley and Bay region.

ALKALI SOILS.

This name is applied in California, and throughout the Arid Region, almost indiscriminately to all soils containing an unusual amount of soluble mineral soils, whose presence is frequently made apparent by the "efflorescence" or blooming out on the surface of a white powder or crust, soluble in water. This alkali becomes most apparent in dry weather following upon rains or irrigation. Later in the season it usually becomes less perceptible from intermixture with dust, as well as from the failure of the soil-water to rise near enough to the surface. The first rain, dissolving the salty substances, carries them partly into the water courses, but chiefly back into the soil, whence they rise again at the recurrence of dry weather. It will readily be inferred that this phenomenon occurs chiefly in low lands of an alluvial origin, and thus includes, prevalently, soils of great native fertility.

The immediate source of the alkali is usually to be found in the soil-water, which, rising from below and evaporating at the surface, deposits there whatever of dissolved matters it may contain. Such water, when reached by digging, is by no means always perceptibly salty or alkaline: and the same is mostly true of the soil an inch or two beneath the surface; for since the soil, acting like a wick, draws up the soil-water and allows it to evaporate at the surface, it is there, of course, that all the dissolved matters accumulate, until the solution becomes so strong as to injure or kill all useful vegetation. The injury will usually be found to be most severe just at or near the crown of the root where the stem emerges from the soil.

One obvious and practically important conclusion to be drawn from the above considerations is that the more water evaporates from the surface of the soil within a season the more alkali salts will be drawn to the surface. Hence, within certain limits, a greater rainfall will bring up a larger amount of alkali; or if, instead of rain, surface irrigation is made to supply an additional amount of water, the same effect will be produced; always provided that the rainfall or irrigation does not go so far as to actually wash a portion of the salts definitely beyond the reach of surface evaporation into lower strata, from which springs or seepage will carry them into the country drainage.

The measure of rainfall or amount of irrigation water that will accomplish one or the other of these opposite results depends in a large measure upon the nature of the soil, as well as of the underlying strata. It is more difficult to wash the soluble salts out of a clay soil than out of a sandy one; and the moisture and accompanying salts will keep rising through the former from greater depths and for a greater length of time after the cessation of rain or irrigation.

Roughly speaking, there is an obvious inverse relation between the rainfall and the prevalence of alkali in the soils; thus, the concurrent increase of alkali and decrease of rainfall to southward is most obvious in the Great Valley of California, but it is also observable more or less to seaward of the Coast Range. The alkali question is of general importance chiefly in that part of the State lying southward of the city of Sacramento. In the region north of that latitude, the more copious rainfall seems to keep soils leached of their alkali, if, indeed, it is naturally as abundant as in the San Joaquin Valley.

Another conclusion resulting from the principles above mentioned is that in the practice of irrigation the nature of the water used is of great importance, since what it contains of soluble salts will be left in the soil by evaporation, helping to swell the mass of alkali year after year, until it may become so great as to render the land unfit for cultivation: provided, again, that the amount of irrigation water used is not so great as to sink through into the strata supplying the country drainage, carrying with it its soluble ingredients also.

The alkali question can hardly be said to possess any general importance east of the Mississippi and Missouri Rivers, where the abundant rainfall suffices, as a rule, to keep in check any injurious accumulation of soluble salts in the soil. It is chiefly in the neighborhood of saline springs that this inconvenience is noted, and the extent of land so withdrawn from profitable culture is ordinarily insignificant. The saline seashore or reclaimed marsh lands constitute the only important cultivatable areas of a similar character, and the means to be employed in their reclamation are well and anciently known. In the Tertiary region of the State of Mississippi we occasionally find tracts of several acres rendered uncultivatable by the alkaline and magnesian salts that ascend from the underlying saline clays into the soil, and many years ago I was led to recommend the use of lime and underdrainage conjointly for the decomposition and removal of the magnesian and other salts infesting such lands.*

Two factors contribute toward rendering the phenomenon of alkali soils much more common in the country lying west of the Mississippi. One is the rapid decrease of rainfall as we advance westward; the other the geologically demonstrable fact of the evaporation in the interior of the continent, first of a great Mediterranean Sea, and subsequently of extensive lakes, whose saline residues have partly been accumulated in their deposits and partly remain dissolved in residuary lakes, such as Great Salt Lake and the "sinks" of numerous streams between the Rocky Mountains and the Sierra Nevada. Even east of the former range in Nebraska, Kansas, and Colorado, alkali tracts are not uncommon, though not usually as extensive, and certainly not as general in their occurrence, as in the undrained country to westward. Hayden's Report of the Geological Survey of Nebraska gives a number of analyses of alkali from that State, proving the composition of these salts to be similar to and quite as variable as is the case with those of the Great Valley of California.

So far as I am aware, no systematic investigation and discussion of this subject, in its relations to agriculture, has been made outside of the State of California, where the preponderance of the agricultural interest and the frequent interference of the alkali with the extensive culture has forced public attention to the question, the more because of its intimate connection with the all-important subject of irrigation. I have therefore considered it best to present somewhat in detail the experience and results obtained in the work done in California under my direction, and published in the reports of the Agricultural College of the University of California for the years 1877, 1879, and 1880. I have added thereto such matter as has since accrued, with such as could usefully be extracted from the reports of the United States surveys.

EFFECTS OF ALKALI.

While the corrosive action exerted by the alkali salts upon the upper roots and root-crowns of crops is the common and most serious source of injury, there is another which manifests itself mainly in the heavier class of soils thus afflicted, when the soluble salts consist largely of carbonate of soda or potash. This is the difficulty, or almost impossibility, of producing a condition of true tilth, in consequence of the now well-known tendency of alkaline solutions to maintain all true clay in the most impalpably divided or "tamped" condition, that of well-worked potter's clay, instead of the flocculent one which it assumes in a well-tilled soil. As this cause of injury is not so well known as the one first mentioned, it will be pertinent to adduce an example observed and studied in the neighborhood of Stockton, San Joaquin County, California, from where a belt of land of this character, about a mile wide and fourteen in length, traverses the valley diagonally to the foot-hills of the Sierra.

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* See Report on Agriculture and Geology of Mississippi, 1860.

This area is readily recognized by its pitted or "pock-marked" appearance, the low portions being impregnated with alkali and more or less incrusted with it on the surface during the dry season, while after rains pools of dark-tinted water remain standing on them for weeks after the higher portions are dry and in tillable condition. These higher portions, forming hillocks and ridges, elevated on an average 10 to 18 inches above the alkali spots, and also bordering the whole tract, consist of a fine, mellow, loam soil, such as would be chosen for a garden, and very productive wherever the alkali does not influence it. Unfortunately, it lies so intimately interspersed with the alkali spots that it is practically impossible to cultivate one without the other. A short time before my visit the owner, Mr. C. L. Overhiser, had made a desperate attempt to conquer the refractory alkali soil. A mixed tract of the two soils had been plowed, cross-plowed, rolled, and harrowed until the harrow produced no further effect, and the result was a seed-bed of soil clods ranging from the size of a pea to that of a billiard ball, but no tilth. At the same time the portions of the "ridge" soil so treated were reduced to an ashy condition of tilth. Some of the alkali land had also been heavily manured, and a fair stand of grain was springing up, but Mr. Overhiser stated that, in accordance with previous experience, he expected to see the stalks "spindle up" and turn yellow about the time of going to ear, unless the weather continued unusually moist, so as to prevent the rise of the alkali to the root-crowns.

Inspection seemed to show that the two soils differ but little in mechanical composition, not nearly enough to account for such difference of tilling qualities, for when worked into a paste with water it was difficult to say which of the two was the heavier soil, and on drying from this condition both formed lumps about equally hard. For the final determination of this question, the two kinds of soil were subjected to comparative mechanical analyses. Both subsoils are very much alike in appearance, being of a gray tint, very compact, and disposed to be cloddy. Both show an alkaline reaction on litmus paper (bluing the red paper), the subsoil of the alkaline spots being, however, decidedly the stronger. The mechanical analysis of the two surface soils resulted in showing that the difference in their proportions of clay and sandy ingredients of the several grades is so slight that under ordinary circumstances it would be insensible in tillage. The chemical examination of the soils resulted thus: The non-alkaline surface soil shows with blue litmus paper a faintly acid reaction (as is usually the case in cultivated soils). The alkaline surface soil shows a sharply alkaline reaction on litmus paper, and portions of it exhibit on the surface white needle-shaped crystals, apparently of carbonate of sodium. In the dead-furrows on the alkali tract stood puddles of dark-colored water, an analysis of whose solid contents is given below, alongside of that obtained by leaching the alkali soil in the laboratory, evaporating the coffee-colored lye, and burning off the vegetable matter. The total amount of residue obtained by the latter process amounted to a quarter of one per cent. of the dry soil. Of this amount 0.158 was again soluble, 0.093 remaining behind as earthy salts, &c. The soluble part was constituted thus:

Constituents.	Soil extract.	Dead-furrow puddles.
	Per cent.	*Per cent.*
Carbonate of sodium	52.74	64.01
Chloride of sodium	38.08	13.06
Sulphate of sodium	13.26	22.93
Tri-sodic phosphate	1.83	
	100.91	100.00

The insoluble part of the aqueous extract gave—

	Per cent. of dead-furrow puddles
Carbonate of calcium	14.02
Tri-calcic phosphate	5.37
Tri-magnesic phosphate	5.77
Silica (soluble in Na_2Co_3)	24.37
Iron oxide, alumina, and some clay (by difference)	50.47
	100.00

It will be observed that notwithstanding the presence of considerable amounts of neutral sodium and calcium salts (which tend to render the soil more tillable), that of about 0.08 per cent. of carbonate of sodium was sufficient to render the soil practically untillable. Although this effect is much less perceptible in the case of soils containing less clay, it cannot fail to be, in many cases where it is not obvious, a determining cause in turning the balance of profit and loss the wrong way, especially in critical seasons. The change of carbonate of soda to some other form, at least, is therefore among the most important points to be gained in the reclamation of alkali lands; and fortunately this can be accomplished with little cost or difficulty by the application of gypsum or land plaster.

Another damaging effect of the alkaline carbonates upon the soil is the dissolution of their humus, which manifests itself in the dark color of the water standing on alkali spots, and the black rings left where such water evaporates; whence the popular name of "black alkali." When leached with water such soils will often appear almost white, and will remain unthrifty for some time, until the humus is restored by vegetable decay. The application of gypsum prior to leaching, however, renders the humus insoluble again, and thus prevents its waste.

RECLAMATION OF ALKALI LANDS.

The most obvious remedy for this evil is, of course, the leaching out of the injurious salts by flooding, and, if possible, underdraining. This method is habitually resorted to in sea-coast marshes, near the mouths of rivers, after the salt water has been excluded by embankments. The limited salty spots so frequently met with in the uplands of some regions are promptly cured by a few underdrains, through which the winter rains wash the salts definitely beyond the reach of the soil-water. Such spots are very commonly found extraordinarily fertile afterward. The problem of affording relief, however, becomes much more difficult when either a stratum of saline water or an earth-layer containing much saline matter lies a few feet beneath the surface in a level region, as is, unfortunately, very often the case in California. When this happens, the evil can only be mitigated, but scarcely altogether cured. According to the value of the land to be reclaimed, one or several of the following remedies may then be employed:

1. When the alkali is not very abundant or very noxious, frequent and deep tillage may afford all the relief needed. For, inasmuch as the damage is in most cases the result of an excessive accumulation at or near the surface, it is clear that frequent intermixture of the surface layers with the deeper portions of the soil may so dilute the injurious salts as to render them powerless for harm. Moreover, since a perfect tilth of the surface greatly diminishes evaporation, it tends to diminish, concurrently, the accumulation of the alkali near the surface. The same effect may be produced by mulching, or by covering the surface with sand. With the aid of deep tillage, it is often possible to raise on salty sea-shore lands root crops, such as beets or carrots, which absorb a large amount of soluble salts and sensibly relieve the soil, so that cereal crops may be grown the second or third year.

2. Underdrains may so far lower the water-table from which the saline matters are derived, and may so far favor the washing out of the salts during the rainy season, that the latter will thereafter fail to reach the surface so as to accumulate to an injurious extent with reasonably deep tillage. The roots of plants will go deeper for the requisite moisture, but will not be injured by the weak saline water below. With the aid of underdrains, in many cases a comparatively small amount of irrigation water may, when applied at the proper time, be made to produce the leaching effect upon the surface soil that would otherwise require a long time and a much larger quantity of water in order to wash the alkali into the country drainage.

3. When the quantity of the salt or alkali is small, but its nature such as to be nevertheless very injurious or corrosive, the evil may be greatly mitigated, or sometimes completely relieved, by the application to the soil of chemical antidotes, cheaply procurable in commerce. In order that the proper antidote may be chosen, it is of course necessary to determine the nature, and in a measure the amount, of the "alkali" by chemical analysis. The salts usually found in the California "alkali" soils, so far as they have come under my observation, are of three kinds:

a. Neutral alkaline salts, such as common salt, Glauber's salt, sulphate of potassium, &c. These are injurious only when present in large quantities, and relief can then be obtained only by washing them out of the soil by flooding, underdraining, &c.

b. Soluble earthy and metallic sulphates and chlorides, such as Epsom salt, bittern, chloride of calcium, alum, copperas, &c. The cheap and efficient antidote to these substances is lime; in some cases even a natural calcareous marl will answer the purpose.

c. Alkaline carbonates and borates. These, especially the former, are injurious in the smallest amounts, rendering the soil-water caustic and corrosive, and in clayey soils rendering it almost impossible to obtain good tilth, by their peculiar action upon the clay. They are most abundant in Southern California, while the second and first class seem to prevail in the Sacramento Valley.

The antidote to these, the true alkali salts, is gypsum or land plaster. The efficacy of these antidotes depends, of course, upon the presence of water, without which they cannot act on the "alkali." They should be sown or spread on the surface, and plowed or harrowed in, to a moderate depth, just prior to irrigation, where that is used; in the case of plaster, put in with the grain; in that of lime it should be put in just before a rain, or irrigation, and not at the same time with the grain or other seed. The amounts to be used of either of these substances will, of course, depend altogether upon the quantity of alkali in the soil, and upon the amount of surface evaporation allowed in cultivation. It therefore varies, and must be ascertained by experiment or analysis in each individual case. Their effect is to convert the corrosive or otherwise injurious salts into "neutral" ones, such as Glauber's salt or common salt, which are from ten to twenty times less injurious than, *e. g.*, the carbonate of soda. It follows that when soils are very highly charged with the latter substance, even its conversion into neutral salts may not suffice to render the soil capable of profitable culture. To effect this it may be necessary to aid the antidote by leaching-out in bad cases. On the other hand, the antidote will, in any case, adapted to its use, aid either of the other methods of obtaining relief. The farmer afflicted with alkali should therefore not feel discouraged or disposed to condemn as useless any one of the measures of relief here described simply because the result is not perfect. The three should be combined whenever possible to the extent justified by the pecuniary value of the land.

In districts afflicted with the carbonate of soda in the soil, it has been found in numerous cases that the simple use of gypsum conjointly with summer tillage, to keep the soil loose, has sufficed to enable land that never before produced anything of value to bear abundant crops. But the failure to secure a similar result in neighboring fields, at times, has caused unnecessary discussions as to the utility of gypsum. It should be remembered that where the amount of soluble salts present in the soil is very large, gypsum may mitigate, but cannot altogether relieve, the trouble; its action must be supplemented by other means calculated to remove the soluble salts from the soil. In case carbonate of soda should not be present, gypsum will effect no improvement at all. To ascertain this is not at all difficult. The presence of carbonate of soda or potash is generally indicated when the water standing on the low alkali spots is of a dark-brownish tint, from the dissolution of the vegetable matter or humus of the soil; in other words, it is what is popularly known as "black alkali." Such alkali will, moreover, impart a brown tint to paper dyed yellow with turmeric; or it will turn the juice of red cabbage green, or the color of blue litmus paper red. Again, if water be shaken up with gypsum and allowed to settle, and some of the clear alkali water added, the gypsum water will be rendered turbid.

ANALYSES OF "ALKALI."

The following table shows in detail the composition of "alkali" salts occurring at different points in California, Nevada, and Utah. The analyses of those from California, as well as of that from Reno, have been made at the laboratory of the Agricultural College of the University of California; the rest are taken from the Report of the United States Survey of the Fortieth Parallel. The summations and minor ingredients are not in all cases given here, the object being to exhibit chiefly the agricultural bearings:

Table showing in detail the composition of "alkali" salts occurring at different points in California, Nevada, and Utah.

Locality.	Soluble salts in 100 soil.	Potassium sulphate.	Potassium carbonate (saleratus).	Potassium chloride.	Sodium sulphate (Glauber's salt).	Sodium carbonate (sal soda).	Sodium chloride (common salt).	Sodium borate (borax).	Sodium nitrate (saltpeter).	Sodium phosphate.
CALIFORNIA.										
Corvallis, Los Angeles County.	1.68	8.74	......	......	51.19	....	22.366	......	....	....
Westminster, Los Angeles County.	0.49	20.62	6.59	......	....	61.48	10.573	......	....	....
Anaheim, Los Angeles County.	......	......	......	......	....	....	Much.	......	Little.	....
Riverside, San Bernardino County.	......	......	......	Little	77.45	0.69	22.17	......	....	....
Merced Bottom, No. 18, Merced County.	......	......	......	......	Little.	Chiefly.	Little.	......	....	....
Merced Bottom, No. 19, Merced County.	1.00	......	......	......	3.88	63.09	1.21	......	10.72	4.10
San José, Santa Clara County	14.70	......	2.92	......	75.98	14.59	6.79	......	....	....
Benton, Mono County	......	......	......	......	Much.	Chiefly.	Much.	......	....	....
Sherman Island, Sacramento County.	......	......	......	0.19	....	....	5.94	......	....	....
Curtis' Ranch, near Stockton	3.73	......	......	......	75.85	6.97	16.38	......	....	1.16
Overhiser's alkali soil, Stockton.	0.15	......	......	......	13.26	52.74	33.08	......	....	1.83
Overhiser's alkali soil, Stockton.	1.02	......	......	......	22.92	64.01	13.064	......	....	Little.
Hueneme, Ventura County	......	5.637	......	......	42.50	....	22.104	......	....	....
Goshen, Tulare County	1.40	......	......	......	44.242	32.98	16.74	......	....	1.97
Mojave, Los Angeles County	......	......	0.58	......	35.38	12.03	31.48	......	....	0.92
Colton, San Bernardino County.	......	......	......	......	26.73	53.08	12.28	......	....	0.60
People's Ditch, Tulare County.	......	......	......	......	1.22	88.09	1.00	......	....	....
Sumner, Kern County	......	......	......	......	19.20	....	57.14	......	....	....
Dos Palmas, San Diego County.	......	......	......	......	29.60	....	29.44	......	....	....
Lemoore, Tulare County	......	......	......	......	Chiefly.	....	Little.	......	....	....
Emigrant Ditch, Fresno County.	......	......	......	......	....	Chiefly.	Little.	......	....	....
Collinsville, Solano County	......	......	......	......	Some.	....	Some.	......	....	....
Skaggs' Springs, Sonoma County.	......	0.12	......	0.97	....	78.54	2.95	12.90	No. 1, trace.	$LiCO_3$ 0.03
NEVADA.										
Reno	......	......	......	......	Chiefly.	....	Some.	......	....	....
Buffalo Peak	......	1.94	0.94	......	63.38	....	70.81	......	....	....
Humboldt Lake	......	......	......	11.62	4.50	24.94	39.57	......	....	0.14
Truckee Desert	......	......	......	......	....	....	95.67	......	....	....
Clover Valley	......	1.94	......	......	33.88	39.04	24.90	......	....	....
Spalding's Marsh	......	0.32	......	......	....	....	89.47	......	....	....
Peko	......	......	......	......	4.60	83.57	7.55	4.49	....	....
UTAH.										
Dugway Station	......	......	......	......	1.05	....	86.33	......	....	....
Salt Lake	......	3.57	......	......	6.21	....	75.08	......	....	....

Table showing in detail composition of "alkali" salts, &c.—Continued.

Locality.	Calcium phosphate (bone earth).	Calcium sulphate, (gypsum).	Magnesium sulphate (Epsom salt).	Magnesium chloride (bittern).	Organic salts of lime and magnesia.	Organic matter.	Salica.	Total.	Antidote.
CALIFORNIA.									
Corvallis, Los Angeles County.	0.51							100.27	Drainage.
Westminster, Los Angeles County.								99.262	Gypsum.
Anaheim, Los Angeles County.		Much	Little.						Drainage.
Riverside, San Bernardino County.								100.301	
Merced Bottom, No. 18, Merced County.					Large				Gypsum.
Merced Batton, No. 19, Merced County.						17.01		100.00	Do.
San José, Santa Clara County.								100.28	Do.
Benton, Mono County									Do.
Sherman Island, Sacramento County.			93.17					99.30	Lime.
Curtis' Ranch, near Stockton.								100.378	Gypsum.
Overhiser's alkali soil, Stockton.								100.81	Do.
Overhiser's alkali soil, Stockton.								100.00	Do.
Hueneme, Ventura County.		2.49	25.61	0.75				99.092	Lime, drainage.
Goshen, Tulare County						1.57		100.00	Gypsum, drainage
Mojave, Los Angeles County.						18.88	0.73	100.00	Do.
Colton, San Bernardino County.						7.10	0.210	100.00	Do.
People's Ditch, Tulare County.						9.21	0.480	100.00	Gypsum.
Sumner, Kern County		0.96	18.31			20.87		100.00	Drainage, lime.
Dos Palmos, San Diego County.		0.772	1.25	12.341	23.67		2.922	100.00	Lime, drainage.
Lemoore, Tulare Co.		Little	Moder.						Drainage.
Emigrant Ditch, Fresno County.									Gypsum.
Collinsville, Solano County.			Chiefly.						Lime.
Skaggs' Springs, Sonoma County.	Ca Co_3 1.08		Mg Co_3 0.54	$\left.\begin{matrix}Sr\\Bd\end{matrix}\right\}Co_3$ 0.13			3.42		Gypsum.
NEVADA.									
Reno		Little	Some.						Drainage.
Buffalo Peak								99.13	Do.
Humboldt Lake							8.25		Gypsum.
Truckee Desert		1.63							Drainage.
Clover Valley									Gypsum.
Spalding's Marsh									Drainage.
Peko									Gypsum.
UTAH.									
Dugway Station		9.11	1.90						Drainage.
Salt Lake		0.57		9.95					Do.

It will be noted that all the various classes of "alkali" salts mentioned above as occurring in California are also represented in Nevada; while in Utah, as Clarence King observes, the occurrence of the carbonates of the alkalies is on the whole rare, common and Glauber's salts, with other sulphates and chlorides, being predominant, and the effect of the salts upon vegetation on the whole less fatal.

A point of great importance to the agriculture of these regions appears from even a cursory inspection of the table, viz., that in many cases phoshates, nitrates, and potash salts form a notable proportion of the "alkali." These are the substances of which the withdrawal by cropping causes sterility of the soil, and the purchase of which forms a standing item of outlay in the farmers' accounts wherever a regular system of husbandry is established. Ordinarily they are found in traces only in the water permeating even the richest soils, the amount present being so small, or in such a condition of insolubility, that they are retained in the soils; but here we find them to be present in such large proportions as to form a regular part of the circulating soil water, the inference being that such soils, when freed from the injurious portions of the "alkali," would be extraordinarily productive, and would remain so permanently, without any additional supply of manure, if it could be assumed that soil water of similar composition would continue to ascend from below. But even if this should not happen, the amounts shown to be actually present in a soluble condition are far from insignificant in themselves, apart from their pointing to some prolific source of the supply. Taking, for instance, the case of Overhiser's "alkali" soil in the above table, we find that the apparently insignificant percentage of soluble phosphates, when calculated to percentage of the total soil (0.0064 per cent. of phosphoric acid) amounts in absolute weight, per acre of soil taken twelve inches deep and weighing about three and three-quarter millions of pounds, to no less than 240 pounds, a quantity which being absolutely available to crops would, *e. g.*, suffice for sixteen crops of wheat of 25 bushels to the acre; or, expressed differently, it is equivalent to a ton of best commercial superphosphate, for which $45 would have to be paid. At least an equal amount must, moreover, be estimated to be present in the soil in the ordinary condition—mechanically absorbed and insoluble in water, yet available to plants. Hence, the above estimate of wheat crops, for which the soil contains an immediately available supply, must be at least double; and after that is exhausted there would still probably remain a supply as great as is ordinarily present in soils.

It should be noted that, in the case of these phosphates, the addition of gypsum would prevent permanently their being washed out of the soil, even in case the leaching-out process were to be resorted to; yet their availability to vegetation would not thereby be impaired. It is highly probable that in many cases where phosphates have not been determined by the analysts, their presence has simply been overlooked, and that their occurrence is much more general than is now proven. The amounts of potash found in some of the "alkali" salts are so great as to justify the conclusion that the supply of this ingredient in the corresponding soils is practically inexhaustible; for the fact that they circulate in the soil water proves that the soil must in the first place have been fully saturated with them, apart from what is actually in solution, and that in all probability the supply comes from the permanent water-table. To this extent the cultivators of such soils would be permanently relieved from the necessity of replacement by manure. The large percentage of potash salts in the water of Great Salt Lake recalls the statement repeatedly made, that certain alkali deserts in Southern Nevada are covered with immense supplies of salts so rich in potash as to render them direcly merchantable, so soon as communication shall be established, for the purposes for which kainite is now imported from Germany. As regards the nitrates, it is obvious that they are locally formed in considerable amounts in the arid regions of North America as well as in that of Bolivia. Minute quantities can be detected in almost all cases in which the carbonates of sodium or potassium form a large proportion of the soluble salts, but it is only under exceptional circumstances of location and rainfall that they can accumulate to a notable extent. Such is the case of the alkali tract in the bottom of the Merced River, from which the specimen, No. 19, was taken. It lies in a local basin of impervious limestone, and forms a low ridge which is only exceptionally overflowed by the river, and that after previous rains, so that even the salts that have bloomed out on the surface are not usually washed away. The niter-bearing deposits of alkali discovered in 1881 near White Plains, Nevada, and since examined more closely by Messrs. Redding and Scupham, of the Central Pacific Railroad Company, occur under circumstances quite similar to those existing in the Tarapaca Desert in Peru. The locality, since named Nitre Hill, is on the southeastern side of the sink of the Humboldt River. It occurs in crevices of decomposing rocks, as well as in the soil of the desert, and consists in the main of a mixture of niter with common salt, the former constituting from 10 to 30 per cent. of the soluble salts.

It is but reasonable to hope that more extensive investigation will show the conditions to be such as to justify exploration, furnishing a home supply of a substance which, however important in war, is not less so in the peaceful art of agriculture; nevertheless, it is quite probable that in the cultivation of regions possessing a climate suitable to the generation of niter deposits, the artificial addition of the latter as a commercial manure will rarely be necessary. Since nitrates are not retained in a soil percolated by water, the use of drainage or leaching-out of the soluble salts will result in the removal of this important fertilizing ingredient from the soil. When known to be present, therefore, the process of washing out should not be carried further, each season, than is needful for the success of crops, and all the means mentioned for reducing the injurious effect of the corrosive salts on the grown roots (above mentioned) should be employed. It goes without saying that in each case crops adapted to the particular circumstances will, other things being equal, bring the best returns. Experience has already in many cases demonstrated the extraordinary productiveness of some "alkali" lands when reclaimed by the means described.

EFFECTS OF IRRIGATION ON ALKALINE SOILS.

During the past two or three years complaints of the increase of alkali on irrigated lands in the upper part of the San Joaquin Valley, especially in the counties of Kern, Tulare, and Fresno, south of King's River, have become more and more frequent. During a personal examination of that region in March, 1880, this important matter was brought prominently to my notice by many farmers. Much difference of opinion prevailed as to the causes of the evil, but there was no question as to the fact of the increased "rise of the alkali."

The latter phrase, commonly used in this connection, really contains the clew to the whole problem. It is emphatically true that the alkali salts rise from below, through the agency of the water evaporating upon the surface. Irrigation has not only increased the amount of water evaporating from the surface, but it has also caused a much greater depth of subsoil to be drawn upon for its alkali. That in many cases the strata lying at depths of from four to six feet from the surface are much more highly charged with soluble salts than the surface soil is painfully apparent from the aspect of the material thrown out in digging the irrigation ditches, and now lining the banks of the latter. In some portions of the "island," embraced between the several outlets of Kern River, south of Bakersfield, these embankments appear as though covered with snow, and the alkali can be bodily picked up by the handful. It would seem as though the rains would have leached these earth-piles long ago; but the rains usually falling in that region are so light that the soluble salts are only washed into the soil to a few inches from the surface, and within a few days after evaporation has again brought them back in the shape of a white crust. In digging wells in the light sandy soils of the "plains," from King's River southward, it has often been found that no perceptible moisture existed, even at the depth of from twenty to forty feet, until after the region had been irrigated here and there for several years. The amount of water needed is at first very large, but when the soil is once filled down to the drainage level, one-half and even one-third of the water previously used will suffice to grow a grain crop.

The rainfall in this region is usually so small (4 to 8 inches) as to suffice only for moistening the soil to the depth of a few feet, and during the time required for the evaporation of this natural moisture the short-lived vegetation of the region rapidly passes through its development. That vegetation consists of a comparatively small number of species of bright spring flowers, which in their season cover the entire country with a dense and beautiful carpet, one and the same flower occupying the ground almost exclusively at times, for many square miles, by virtue of the law of the "survival of the fittest." Were there any crop of a habit similar to these flowers that could be profitably grown on these plains, irrigation could obviously be dispensed with. The settlers of the region have tried what seems to be the next best thing, viz., to grow grain crops of a short period of growth, and therefore needing irrigation only during a small portion of the dry season. In so doing they have moistened the soil to a considerably greater depth than was reached by the rain water before, and as a consequence the annual evaporation has greatly increased. The irrigation water, moreover, has brought with it, from these depths, all the supply of alkali salts that before had gradually been washed beyond the reach of the ordinary rainfall by an occasional wet season. Each succeeding irrigation, followed by evaporation, tends to accumulate the salts nearer the surface, so that finally the root-crowns of the grain crops are "burnt up" before even beginning to head. The evil will, of course, be greatly aggravated if the water used for irrigation originally contains any considerable amount of alkaline salts, which are superadded to those already in the soil strata. Some important practical bearings of this point will be discussed further on.

REMEDIES FOR THE "RISE OF THE ALKALI."

It is obvious that the "rise of the alkali," following upon irrigation, cannot be remedied by the use of the chemical antidotes alluded to above. While they do convert the most injurious salts, carbonate of soda and sulphate of magnesia, into much less active compounds, yet these will remain in the soil, and if in sufficient quantity will ultimately become noxious to shallow-rooted vegetation especially. In some districts afflicted, the natural alkali consists only of such "neutral" salts, as common and Glauber's salt; as, for instance, in a part of the rich Mussel Slough country around Hanford, Tulare County, where, at the time of my visit, dead spots were appearing in the magnificent grain fields, at the time when the grain was but a few inches high, the evil being worse wherever the crop was late and had not yet shaded the ground. Moreover, it was obvious and strikingly worse wherever the soil was sufficiently clayey to form a hard crust on the surface, a fact well known and recognized by farmers in the alkali regions, but often ascribed simply to the constriction of the stems by the contracting crust. The effect of the latter may, it is true, be noticed in adobe districts, where there is no alkali, and undoubtedly bears its share in doing damage, but the injury it creates is doubly great in alkaline soils.

In the early stages of the growth of cereals, the pulverization of this crust may be accomplished by harrowing or rolling, with great benefit to the crop. But in the upper valley it can rarely be done after the last irrigation without considerable mechanical injury. That a soil having such a surface crust dries much more rapidly than the same soil when kept in good tilth, is a fact too well known to require discussion. The dense crust absorbs water much more powerfully than does the loose soil beneath. The moisture is forcibly drawn from the latter into the surface crust, and there evaporates quickly under the influence of air and sunshine, hardening the crust more and more, and accumulating therein an increasing amount of alkali. To illustrate this, imagine a sponge, representing the loose soil, to be saturated with water, and a hard-burnt brick, representing the crust, to be laid upon it; the brick will take all the water from the sponge. Yet, if the brick be soaked in water and the sponge pressed on it, the sponge will not take up a particle of moisture. It is thus obvious that in alkaline soils the formation of a surface crust must of all things be avoided. In other words, as stated above, "deep and frequent tillage" is one of the foremost needs in such soils. And as this condition cannot be fulfilled in the case of broadcast crops, the conclusion is that broadcasting, and with it practically grain-growing, must ultimately be abandoned in the alkali regions, and hoed crops substituted, which will admit of the ground being kept in perfect tilth throughout the season.

CROPS FOR ALKALI SOILS.

The condition of preventing evaporation from the surface is also measurably fulfilled by such crops as "alfalfa," which not only thoroughly shades the ground, but in addition causes almost the entire evaporation water to pass up through its deep roots to the leaves, so as not to reach the surface at all. Such accumulation of alkali in and around the roots as can occur under such circumstances is too much diluted to hurt the plant. The fact that alfalfa succeeds perfectly on ground too much charged with alkali to grow grain is notorious; only care must be taken to prevent injury to the root-crowns, while the plants do not yet cover the surface, by timely irrigation.

If circumstances permitted the profitable cultivation of alfalfa on so large a scale, the alkali districts would perhaps have little cause to seek further. The experience with alfalfa, however, clearly points the way for the selection of crops better suited to the circumstances than grain, whose shallow roots are much more liable to alkali corrosion than is the case with the tap-rooted, or other deep-rooted plants. It is among these, then, that the alkali regions should seek for crops, of which the product shall be sufficiently valuable to bear the expense of inland transportation, under which these districts are now suffering. Next to these, the search should be for such as will be successful in alkali lands, provided the soil be kept well tilled through the dry season, *i. e.*, "hoed" crops.

In the former category, one of those standing foremost in promise is probably cotton, the success of which in that region is already shown by experiments made, the profitable production being at present limited only by the demand for the staple on this coast, which may soon be increased by the establishment of cotton factories. Of other textile crops, hemp, jute, and ramie at once suggest themselves for trial.

Of oil crops, the castor bean is perhaps the most available and most certain of success, always excepting the despised "white mustard" or "wild turnip," whose rank growth as a weed shows what might be done with it if grown for the manufacture of rape-seed oil. Root crops, being too bulky for profitable shipment by rail, will not be available to any great extent at present, unless as dairy feed, in conjunction with alfalfa, for conversion into butter and cheese. But beets, carrots, turnips, sweet potatoes, &c., all fulfill, to a greater or less extent, the conditions above formulated for successful culture in alkali soils. The culture of fruits, both large and small, that can be shipped in the dried condition, or in the shape of jellies, &c., is also an available industry, scarcely yet touched in the alkali regions. Raisins and prunes especially deserve attention as pretty certain of success.

Among hoed field crops available for that region, sorghum and sugar-cane deserve attention. It is true that in general the presence of a large supply of soluble salts in the soil is deemed unfavorable to the profitable production of sugar, since it is apt to render the juice difficult to crystallize and to increase correspondingly the proportion of molasses produced. Actual trial, however, can alone determine the question here, and the results of some experiments made in this direction during the past season will be found in another place in the present report.

It would really seem as if in the broadcast culture of cereals, the farmers in the alkali districts had made the worst possible selection for the permanent good of agriculture in their region. That a change of system in this respect is imperative, can hardly be questioned by any candid observer of the facts. And it may well be questioned whether the necessity imposed by nature, of more varied and careful farming than has heretofore obtained, may not prove a blessing in disguise when rightly understood and acted upon. The planting system enriches a few individuals, almost always at the cost of the soil's permanent productiveness. It is small farms and intelligent culture that constitute the prosperity of an agricultural community.

SUB-IRRIGATION VS. SURFACE IRRIGATION.

The injury arising in alkali lands from the formation of a consolidated surface or crust, subsequent to irrigation by flooding, suggests at once the application of the water in such a manner as to avoid this evil, viz., by sub irrigation. To a certain extent the advantage so secured is well understood in the irrigation districts, the water being often applied only by the use of furrows or ditches, which divide the land into narrow bands, and from which the soil is moistened by "soaking sideways" from the ditches. The great multiplication of the latter, and their interference with the operations of culture on the large scale, have generally caused the use of this mode of irrigation to be restricted to small cultures. Even a cursory inspection of the state of things in the alkali regions shows that in the plots sub-irrigated by ditches the rise of the alkali has, as a rule, been very much less than in the case of adjoining ones irrigated by flooding; and, in the latter, the high spots that have not been covered with water frequently escape damage, while the low portions are scorched with the alkali. This, at least, is the result when the amount of alkali present is not very great. When the soil is very heavily charged, the high spots being the first to dry, are also the first to be injured by the alkali drawn to the surface by evaporation, while in the low spots the grain may reach a greater development before being killed. Manifestly, the object to be attained is to prevent the irrigation water from reaching and evaporating from the surface at all, if possible. To accomplish this fully it would be necessary to know how far upward water will rise when applied to the several soils. Some data concerning this point are given in books on agricultural science, but they are not of such a character as to permit the prediction of this measure with respect to any other given soil. We know in general that in coarse, sandy soils water rises rapidly, but only to a moderate height, stopping there; while in soils composed of fine materials, whether clay or fine silty matter, or both mixed, the rise is slow, continung for months in some cases before reaching the highest point, which may, however, be twice or three times as much above the water surface as in the case of sandy soils. For instance, in coarse, sandy soils, like those of portions of the plains of Tulare, or of parts of Stanislaus, the water may, in the course of three or four days, reach its highest point at twenty inches; while in adobe soils, or in the gray silt soils of Eel or Santa Clara Rivers, it may take ten days to reach the same height, but will continue to rise slowly for several months before reaching the maximum height of about 50 inches.

These points are illustrated by the following table of results, obtained by placing in a vessel containing water, kept at a constant level, wide glass tubes filled with the different soils, and recording from hour to hour, at first, then from day to day, the heights reached by the ascending moisture.

No. 1.—Coarse, sandy soil, from Morano Station, Stanislaus County, may be considered as representing the more "open" plains soils of Kern and Tulare Counties.

No. 2.—Hill adobe soil, from the campus of the University. A very refractory clay soil, very tenacious when wet, and when dry, untilled, opening into wide, gaping cracks to 18 inches depth.

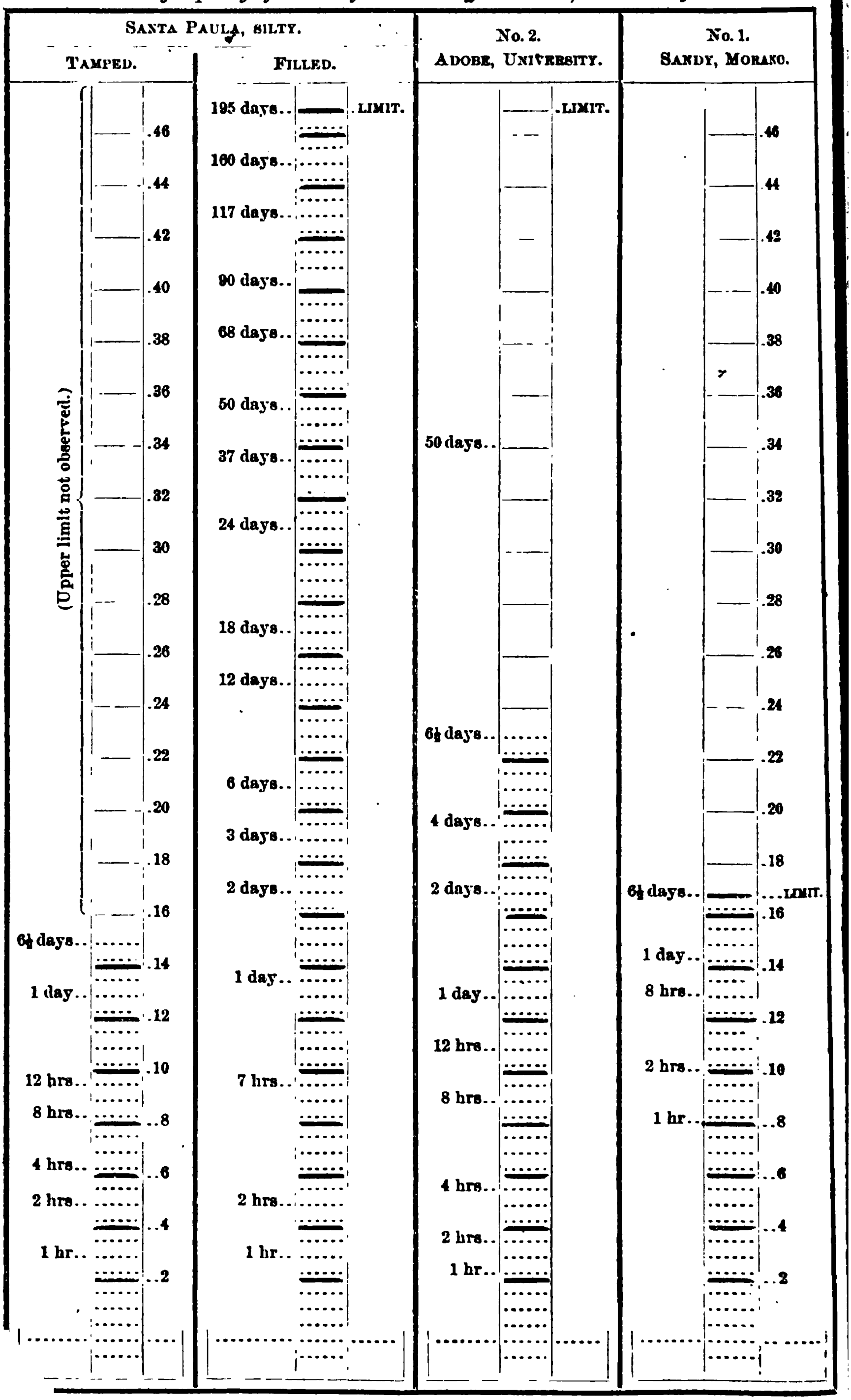
No. 3.—Light sediment soil, from Mr. Blanchards' orange orchard, on the first bench of the Santa Clara River Valley, at Santa Paula, Ventura County. Is remarkable for remaining moist within 20 inches of the surface throughout the season, the water table being at 15 to 20 feet below the surface; very easily worked at all times.

No. 4.—Same as the last, but somewhat compacted by light ramming or tamping in the tube, as it would be if left untilled.

With the exception of No. 4, the above soils were in a condition of perfect tilth.

TABLE

Showing rapidity of ascent of water in different soils, and limit of same.



This table illustrates forcibly some important points in the management as well as in the natural peculiarities of soils. The coarse sandy soil represents not only its kind, but also any well-tilled soil; while, on the other hand, the adobe soil illustrates the case of any compact soil, whether naturally so or rendered so by imperfect tillage or the prevalence of carbonate of soda. The extreme slowness of the ascent of the water toward the end of its possible rise shows why a poorly-tilled adobe soil will open into gaping cracks a short time after the cessation of rains; while a well-tilled soil, maintaining both a quicker supply from below and a slower rate of surface evaporation, may maintain moisture throughout the dry season. At the same time, it informs us that sandy soils stand in especial need of a more dense subsoil, capable of drawing up moisture from greater depths than it is possible for a sandier mass to do, and thus supplying moisture to the roots of plants, while allowing but little surface evaporation.

In the case even of the light sediment soil from Santa Paula the difference between the rate of ascent in the tilled and the compacted soil is very apparent, and, in the case of the adobe, subsequent experiments showed that, when in the compacted state, the rate of ascent may be less than half of what it is in the lower portion of the column representing the tilled adobe.

The many and somewhat complex bearings of this subject on the chief varieties of soils in the alkali region will form the subject of farther investigation, now in progress. One point, however, may even now be usefully discussed, viz., that while it is certain that water applied to a soil like No. 1, at the depth of 24 inches, cannot reach the surface at all, and can, therefore, evaporate but very slowly, and not in such a manner as to accumulate alkali to an injurious extent near the surface; it does not, therefore, follow that in order to produce the same result in the adobe or silt soils the water has to be applied at the maximum depth of 50 inches. For, in a field planted with any growing crop, the leaves of the latter evaporate a very large amount of moisture, thus intercepting that which would otherwise rise to the surface and evaporate there. This is a matter of every-day experience. The inference is, that ditches or pipes designed for sub-irrigation would not in such soils require to be laid to any unreasonable depth in order to prevent the rise of alkali resulting from surface evaporation.

It is obvious that in this connection the subject of sub-irrigation by means of a system of pipes, of whatever material, acquires exceptional interest for the alkali districts, since its judicious use would not only obviate the rise of the alkali, but also accomplished a great saving of irrigation water—the latter being a matter of especial importance where the water itself is somewhat tainted with alkaline salts, as will be shown below. That this system is not likely to be used in connection with the growing of field crops on a large scale, is true, since the expense of the pipes is too great for any land not yielding very high returns. But when the continued rise of the alkali renders lands, intrinsically fertile, incapable of farther production, under the system of surface irrigation, the owners will needs have to take their choice between the abandonment or the adoption of such systems and objects of culture as will yield them profitable returns under the circumstances. The culture of cereals must "go to the wall," and that of grapes, fruits, and such other crops as can be made to yield high returns under intense culture must take its place. It is not, perhaps, unreasonable to hope that the improperly so-called "asbestine" sub-irrigation pipe (consisting of hydraulic cement pipe that can be cheaply and rapidly laid by a special appliance, at an expense not exceeding, it is said, $35 per acre) may become so generally available by the home manufacture of the material as to form a practical solution of this great problem.

It should not be forgotten that, with a slight change in the manner of laying and outletting, this sub-irrigation pipe may be made to serve also for underdrainage; so that land provided with it could be completely leached of its surface alkali by flooding during the season when water is abundant.

LAKE AND RIVER WATERS OF THE GREAT VALLEY, AND THEIR QUALITY FOR IRRIGATION PURPOSES.

In the foregoing discussion of the "alkali" question it has been tacitly assumed that the soluble salts already in the soil alone need to be considered, the water used in irrigation being regarded as pure water only. This, however, is far from being actually the case with any natural water, and in the alkali districts especially the irrigation water is almost always more or less impregnated with the very same salts whose presence in the soil is so objectionable. It is obvious that when the amount of salts so added annually is at all considerable, it may ultimately so swell the quantity in the soil as to give rise to trouble. My attention was first directed to this subject by reports from the lands bordering upon Tulare Lake, to the effect that, although to all appearance of the best alluvial character, they would either not produce at all, from the outset, or else would cease to produce after a few years when irrigated with the water of the lake. The beginning of the investigation of this subject was given in the last report published. (See report for 1878–'79, p. 27.) A soil from the southeastern corner of the lake had been analyzed, and found to contain, in abundance, all the elements of fertility, yet it would produce nothing, and that under circumstances which led me to believe that the trouble was caused by alkali (carbonate of soda) contained in the soil. Analyses seemed to confirm this supposition, but at the time the report went to press the water of Tulare Lake itself had not been examined. Water samples were soon afterward received and analyzed, and the result showed it to contain so much alkali of the most corrosive character as to render it utterly unsuitable for irrigation. It then became apparent that on of the great bodies of water in the State that had been counted upo for irrigation purposes might have to be altogether rejected. Th importance of the question led me to make the matter the subject o special inquiry during a visit to the upper valley, made under the auspices of the United States census, in March of the present year.

A personal examination of Kern Lake, and of the region lying betwee it and Buena Vista Lake, as well as of the Mussell Slough country, o Tulare County, satisfied me that in none of these rich agricultural se tions could the slightest increase of alkali be safely risked; and anal ses subsequently made of the waters of both Kern and Tulare Lak prove that a very few years' use of the water now filling either of the reservoirs would be promptly fatal to the productiveness of the lan irrigated. As regards Kern Lake this is obvious enough from a casu examination and tasting of the water. Having been shut off from t natural influx of Kern River for a number of years, it has been rapi evaporating and receding from its former shores, so that at the time my visit a difference in level of over four feet had been produced fifteen months, leaving high and dry a boat wharf built at that tim

About eighteen months before all the fish and turtles in the lake had suddenly died, creating a pestilential atmosphere by their decay, and even the mussels were mostly dead, a few maintaining a feeble existence. A strong alkaline taste and soapy feeling of the water fully justified their choice of evils. The tule marsh, laid dry by the recession of the lake, was thickly crusted with alkali, and the tules dead, except where still moistened by the water of the lake, showing that the latter was not yet too strong for such hardy vegetable growth, albeit fatal to animal life.

Buena Vista Lake was stated to be in a similar condition, but not yet quite so far advanced in evaporation, and still maintaining some animal life in its waters, having lost its connection with the river more recently. Tulare Lake is well known to be full of fish, and as it annually receives the overflow of Kern and the regular inflow of King's River, its evaporation and recession has been much slower; yet its water's edge is now distant several miles from the former shore line, and, as the water of the rivers is more and more absorbed by irrigation, it will doubtless continue to recede until a point is reached at which the regular seepage from the irrigated lands will balance the evaporation. This epoch would seem, however, to be quite in the future as yet, for the rate of recession has, apparently, not sensibly changed in the last few years.

It is not likely, in any case, that the water of the lake will be more abundant or less impregnated with mineral matter than is now the case, at the time when the state of equilibrium shall have been reached. In order to assure a fair determination of this important point, water samples from the opposite ends, as well as from the middle of Tulare Lake, have been analyzed, with the results given below. The sample of Kern Lake water was taken by myself, on the north shore of the lake, March 24, 1880. Tulare Lake water, No. 1, was taken about 300 yards off shore, near the southeast corner of the lake, inside of Root Island, near land lately reclaimed by Mr. E. R. Thomason, of San Francisco. Samples Nos. 2, 3, and 4 were taken according to my directions, near the middle of the lake, under orders of the King's River Canal and Irrigation Company, respectively, at the surface, at ten feet depth and at twenty feet depth. Of these, only one (No. 3) was fully analyzed, the total of solid contents only being determined in the case of the others, whose composition could not, of course, differ in any material respect. No. 5 is water taken by Mr. E. Jacob, of Visalia, at a point off the mouth of Mussel Slough, in the estuary of King's River, March 28, 1880. The sample was taken from the surface at a time when a strong northwest wind prevailed, which of course had a tendency to bring a larger admixture than usual of the fresh water of King's River:

Grains per gallon of—	Total residue.	Carbonate of soda.	Common Glauber's salts, &c.	Carbonate lime, magnesia, and silica.	Vegetable matter.
Kern Lake	211.50	64.37	115.41	9.20	22.43
1. Tulare Lake, south end	84.44	27.92	37.85	13.44	2.28
2. Tulare Lake, middle, surface	81.95	35,30	35.96	5.37	5.32
3. Tulare Lake, middle, 10 feet below surface	81.83	30.46	39.49	7.47	4.41
4. Tulare Lake, middle, 20 feet below surface	81.72	......	......	......	......
5. Tulare Lake, near mouth of King's River	38.55	13.46	15.01	5.11	4.97

To convey to those unaccustomed to the consideration of such matters an idea of the meaning of the above figures, it may be stated that the solid contents of river waters vary usually from 5 to 12 grains per gallon. The water of Tulare Lake, where it is undiluted by the inflow of King's River, is therefore about ten times, and that of Kern Lake about twenty-six times, stronger than an average river water. Even this, however, conveys but an inadequate idea of the relation sustained by these waters to organic life. The average sea water (containing mainly common salt) is about ten times stronger than the water of Kern Lake, as regards its solid contents. Yet, in sea water fresh-water fish live freely during part of the season; while in Kern Lake the fish died at a time when, according to a minimum estimate, the water must have had about twice the strength of Tulare Lake, or about one-thirteenth of the strength of sea water. This shows strikingly the deadliness of the Kern Lake alkali, as compared with sea salt; or, in other words, of Kern Lake water as compared with tide water.

In comparing the quality of the alkali of Tulare Lake with that of Kern Lake, we find that in the former the proportion of the carbonate of soda (being the chiefly injurious ingredient) is about 1 to 2.83 of the whole solid contents, while in the latter this ratio is 1 to 3.28.

A part of this difference is, however, due to the large amount of vegetable matter dissolved in the strong lye filling Kern Lake; and, when allowance is made for this, the ratio becomes nearly the same in both waters.

As regards the relation between common and Glauber's salt on the one hand, and carbonate of soda on the other, in these several cases, it appears that in the evaporation process there is a gradual relative decrease of the carbonate of soda; for we have for this ratio:

Locality.	Carbonate of soda.	Common and Glauber's salt.
Tulare Lake, near mouth of King's River	1	1.11
Tulare Lake, middle	1	1.[illegible]
Tulare Lake, south end	1	1.35
Kern Lake	1	1.[illegible]

Whether this change in composition arises from a chemical change of the carbonate of soda or from an actual accession of the other salts is not easy to determine. The latter is the more probable explanation, inasmuch as actual veins and strata, several inches thick, of what from the description appears to be mainly Glauber's and common salt, have been found in the region between Tulare and Kern Lakes, in digging ditches. But whatever may be the cause of this slight difference in the composition of the alkali in the different portions of Tulare Lake, that difference is not sufficient to invalidate the broad conclusion that the water of that lake, as at present existing, is unfit for any of the ordinary processes of irrigation.

To prove this it is only necessary to consider what is the amount of the alkali that, under the usual practice, would accumulate near the surface. Ten inches of water is the usual estimate of what is needed in the course of the year to perfect a crop. Now, one gallon of water will cover about 1½ square feet 1 inch deep, or two-thirds of a gallon 1 square foot; or 6⅔ gallons per square foot is equal to 10 inches depth of water

Assuming the average solid contents of Lake Tulare water at 80 grains per gallon, this quantity, upon evaporation, will leave near the surface, upon each square foot irrigated, 533 grains or about 1⅛ ounces of alkali. This amount pulverized and strewn over the surface would cover the whole of it thickly with white—a phenomenon already but too familiar to the farmers of that region. That the operation could not with impunity be repeated many years on any soil, least of all on such as are already more or less charged with alkali, scarcely requires discussion.

To illustrate the latter point, a tule soil, taken by Mr. E. Jacob, of Visalia, from his land near the mouth of Mussel Slough, was leached with water to ascertain the amount of alkali present. This was found to be 0.32, or about one-third of one per cent. Of this, supposing it to be of the same composition as that found in the water of the lake, about three-eighths, or, otherwise expressed, one-eighth of one per cent. of the whole soil is carbonate of soda, amounting to over two ounces in each cubic foot. This is within the limits of endurance of ordinary vegetation, at least in so fertile a soil; but double or triple it by evaporation, and that limit is passed.

To this conclusion, nevertheless, it is objected by some that the borders of Tulare Lake are thickly edged with vegetation in many places, and that in some cases garden plats have been successfully irrigated with the lake water for several years. One such case is reported by Mr. Jacob, of Visalia, who took sample No. 5 of the above table of analysis from the mouth of a small canal serving for the irrigation of a vegetable garden, which was doing well at the time. A few other similar cases have been mentioned to me. These, however, do not invalidate at all the conclusion that the lake water cannot serve for general irrigation, as usually practiced. Even the strongest water in the lake, near its southern end, is not so strong as to injure the roots with which it comes in contact, so long as it is not concentrated by evaporation. But in the low tule lands thus far tried this cannot occur to any great extent, on account of the constant presence of surplus water, and the frequently repeated irrigation, by which the strength of the alkali in the soil is kept below the point of injury. But it would be quite otherwise where the same water, used sparingly two or three times during the season, would evaporate so as to accumulate all its alkali near the surface. Yet it is probable that if the soil so irrigated were to be leached by a very copious and continued flooding once a year, so as to carry the accumulated alkali into the underground drainage, the water might be used with impunity. This would be especially the case with land underdrained, and could be more readily accomplished the smaller the amount of water originally used. The minimum amount, undoubtedly, would be the outcome of pipe sub-irrigation, referred to above, and would be applicable to the case of orchards, vineyards, &c. It might even be possible, in some cases, to make the same pipe system serve the purpose of irrigation at one time, and that of underdrainage at another. But, in whatever way accomplished, a leaching-out of the alkali, accumulated from evaportion of such waters from time to time, would be a necessary condition of their continued use for irrigation purposes.

This principle applies, in fact, to many more cases than is ordinarily supposed. Irrigation, without proper provision for drainage, has in the past, in very many cases, been the cause of the abandonment of lands once abundantly fruitful, which were supposed to be exhausted by culture, but in reality had simply become overcharged with injurious salts, or alkali, from the ever-repeated evaportion of enormous quantities of water, whose solid contents, though naturally very small, had nevertheless been too strongly concentrated in the soil. This naturally leads us to the consideration of the river waters of the San Joaquin Valley, and their relation to the origin of the alkaline character of the waters and soils of the upper valley.

GEOLOGICAL HISTORY OF THE VALLEY OF CALIFORNIA.

That the great valley of California was in remote (Quaternary) times a great inland lake, which disappeared in consequence of the breaking through, first, of Carquinez Straits, and afterwards of the passage of the Golden Gate, is a matter scarcely doubted even by the casual observer. A glance at the map also shows that, from some cause not yet fully understood, there exists in the southern part of Fresno County a ridge across the valley by which the waters of King's River are thrown southward into Tulare Lake. At present this ridge is intersected at its western end by Fresno Slough, through which the surplus waters of Tulare Lake or of King's River, can find their way into the San Joaquin. But previous to the formation of this outlet the entire upper valley, evidently, was a shallow lake, of which Kern, Buena Vista, and Tulare Lakes are the remnants. From the data given below, it appears certain that the entire lake of the great valley had a somewhat alkaline water; and they also show that, probably, the residuary lake of the upper valley was more strongly so at first, and rendered more so in the course of long periods of evaporation, during which "sheets of alkali" (to use the language of the workmen who dug the Kern Canal) were formed among the alluvial deposits of the western margin of the valley.

It is only thus the fact already alluded to, viz., that the deeper portions of the Kern Valley alluvium are most strongly impregnated, can find its explanation. Whence did all the alkali come? A partial answer to this question is readily found in the frequent "blooming out" of soluble salts on the face of hillside cuts. Evidently a good deal of such salty matter pre-exists in the geological strata of the valley, and must be continually washed out by percolating water, which carries it into the lower portions of the country, and finally into the lakes themselves. But it would be difficult to account for the large accumulation of these salts in the Kern Valley if there were not some more copious and lasting source. For this we would naturally look to Kern and King's Rivers, themselves, and analyses of the waters of these rivers were accordingly made, with the results given below:

ANALYSES OF WATERS OF THE GREAT VALLEY.

At my suggestion, an investigation of the waters of the chief rivers entering the valley between King's River and the Sacramento was undertaken by Mr. Horace G. Kelsey, of Merced Falls, as a graduating thesis at the University of California, in 1881. This includes the results given below under Nos. 12 to 15, both inclusive. The analyses of the water of the Sacramento and Los Angeles Rivers were made for the State board of health by Mr. Walter Jones (of the class of 1878, University of California), and published in the report of that body for the year 1878. To facilitate comparision, the table includes again the analyses of the lake waters already given above, and also analysis of the water found a few feet beneath the surface at Point of Timber, Contra Costa County, near the junction of the San Joaquin and Sacramento, in uch abundance as to suggest its use for irrigation.

No. 1.—Water from Los Angeles River, taken from a hydrant in the city of Los Angeles, September, 1878.

No. 2.—Water taken from the grand cañon of Kern River, in April, 1880.

No. 3.—Water from irrigation ditch of the Kern Valley Irrigation Company, taken at a point two miles below Bakersfield. Both the above samples were furnished by the superintendent of that company. The water at that time was just beginning to receive the melting snows, and was slightly turbid, and of course somewhat diluted, as compared to its condition in winter.

Nos. 4 to 10 have been described as above.

No. 11.—Water taken from King's River, at Kingsbury, June 19, 1880, by Mr. J. D. Schuyler, of the State engineer corps.

No. 12.—Water taken from King's River, at Kingsbury, in November, 1880, before any rains had fallen.

No. 13.—Water taken from the San Joaquin River, at the crossing of the Southern Pacific Railroad, in November, 1880, after the first rains; perfectly clear.

No. 14.—Water taken from the Merced River, at Snelling, Merced County, in December, 1880, after the first rains had raised the river slightly above the lowest water-mark. It was slightly turbid with clay, which filtration could not remove, but was eliminated after evaporation.

No. 15.—Water taken from the Mokelumne River, at Woodbridge, San Joaquin County, in November, 1880, after the first rain, which had slightly raised the river. Water slightly opalescent from suspended clay, and residue corrected for same, as in No. 14.

No. 16.—Water of the Sacramento River, taken from a hydrant in the city of Sacramento, September 19, 1878. The data have been recalculated from the published results, so as to conform to the mode of presentation here adopted, which explains the apparent discrepancy of the tables as here given.

No. 17.—Water from a well at Point of Timber, Contra Costa County, furnished by Mr. T. W. A. Carter, of that place. This water is found abundantly about eight feet below the surface in that region, and, if available for irrigation, could be obtained in unlimited quantities by pumping, but the inhabitants stated that it "would kill the soil."

Grains per gallon of—	Total residue.	Carbonate of soda.	Common Glauber's salts, &c.	Carbonate of lime, magnesia, silica.	Vegetable matters.
1. Los Angeles River	17.53	....	8.37	0.16	......
2. Kern River (cañon)	9.49	1.22	1.77	5.55	0.95
3. Kern River (ditch)	9.62	1.23	2.21	5.33	0.85
4. Kern Lake	211.50	64.37	115.41	9.29	22.43
5. Tulare Lake (south end)	84.44	27.92	37.85	13.44	2.28
6. Tulare Lake (middle surface)	81.95	35.30	35.96	5.37	5.32
7. Tulare Lake (middle, 10 feet below surface)	81.83	30.46	39.49	7.47	4.41
8. Tulare Lake (middle, 20 feet below surface)	81.72	....	....	....	......
9. Tulare Lake (near mouth of King's River)	38.55	13.46	15.01	5.11	4.97
10. Tulare Lake (near outlet of west side canal, 10 feet below surface).	76.00	30.95	33.95	6.60	4.50
11. King's River (June)	4.13	0.003	0.86	3.27	......
12. King's River (November)	5.03	....	....	....	0.19
13. San Joaquin River	4.54	0.45	0.15	2.15	0.89
14. Merced River	5.64	0.19	0.09	4.18	......
15. Mokelumne River	6.97	....	0.42	4.42	3.70
16. Sacramento River	6.69	0.27	1.42	5.00	......
17. Point of Timber (San Joaquin Delta), well water	67.75	10.83	48.41	7.41	1.10

The following table shows more in detail the composition of three of the waters given above, in a general manner:

Ingredients.	Los Angeles, city hydrant, river water.	Tulare Lake, middle, ten feet below surface.	Sacramento River, city hydrant.
Carbonate of soda	.....	30.46	0.27
Chloride of sodium (common salt)	1.004	20.27	1.42
Sulphate of sodium (Glauber's salts)	4.134	7.54	
Carbonate of lime	0.382	2.49	0.31
Carbonate of magnesia	4.287	4.21	0.35
Silica	1.171	0.69	1.65
Sulphate of lime	0.776	.....	0.42
Phosphate of lime	2.182	.....	1.48
Iron and manganese carbonates	0.259	.....	0.63
Alumina	0.100	0.29	0.07
Vegetable matter	.....	4.41	.....
Total residue	17.530	81.83	6.60

In discussing the quality of these waters, in reference to irrigation, it must be understood that the group of ingredients mentioned in the fourth column of the first of the above tables, viz., carbonates of lime and magnesia and silica, are not only useful to vegetation, or unobjectionable, but are also very soon deposited and retained in the soil. We therefore leave them out of consideration, so far as the alkali question is concerned. For this the carbonate of soda and the salts mentioned in the third column are of chief importance, and among these, the corrosive carbonate of soda is the most noxious by far. The prominent facts shown in the above table may be thus stated: The water of the Los Angeles River, though containing a large aggregate amount of solid ingredients, has none of the carbonate of soda, but only neutral and earthy salts, of which a very large amount is injurious. This fact, together with the perviousness and free drainage of the lands irrigated, explains why it is that even those which have been longest under cultivation and irrigation in that region do not show any serious increase of alkali, and may never do so if abundance of water is used, at least from time to time. But, as irrigation water becomes more closely utilized and relatively more scarce, the leaching process will occur less frequently, and the accumulation of alkali salts near the surface will become more and more apparent.

In the water of Kern River, the proportion between the carbonate of soda and the other salts is almost exactly the same as in the water of Tulare Lake, in the proportion of about one to twenty-two. In other words, if twenty-two gallons of Kern River water were boiled down to one gallon, the alkali in this water would, in quantity and quality, be the same as in the water of Tulare Lake; and if this gallon was still further reduced to about three pints and a half, the remaining water would have about the composition of the water of Kern Lake, as it was in March, 1880. Comparing the water of King's River with that of Kern River, we find that in the latter the aggregate amount of solid residue in the water is less than half that found in Kern River. This, however, is to some extent due to the season at which the water was taken, it being then diluted with snow water. For purposes of comparison, we should take the figure obtained for the residue in November, when the solid contents were at their highest amount. But even on this basis we find that the amount of carbonate of soda in the King's River water is utterly insignificant, being not yet one hundredth of a grain per gallon, against about one and a quarter grains per gallon of Kern River water, while on the same assumption the percentage of other soluble salts is about twice as great in the latter.

Of the other rivers of the valley the San Joaquin shows the highest amount of carbonate of soda, but yet only about one-third as much as Kern River. The Merced has less than one-sixth as much of the same, the Sacramento less than one-fourth. Between the latter two we find the Mokelumne with none at all, there being some chlorides of magnesium or calcium in solution, to the extent of about one-tenth of a grain per gallon—an insignificant amount. The water of the Los Angeles River, likewise, is free from carbonate of soda; but its aggregate of soluble salts is somewhat high, exceeding in this respect even Kern River by one and a half grains. It is credited with a very large proportion of phosphates, as is also the Sacramento River. In the other analyses made these were not determined for want of material.

It appears from these comparisons that of the streams examined the Mokelumne has naturally the best water from the irrigator's point of view. King's River comes next, with a water whose purity is the more remarkable as its sources lie so near those of the Kern. The Merced comes next, having somewhat less of the objectionable carbonate of soda than the Sacramento; but, if corrected with gypsum, its waters would be placed at head of the list as the purest of all. The San Joaquin River has the smallest total of solid contents of all the waters taken at the same season, but contains over twice as much carbonate of soda as the Merced; if corrected with gypsum, its water would contain less than half as much of soluble salts as that of the Sacramento, one-half less than King's River, and only one-fifth as much as that of Kern River.

It will thus be seen that the correction of the irrigation waters of the valley by means of gypsum would in all cases but that of the Mokelumne effect a very important improvement as regards the safety of their continued use on soils of which but too many have already the full dose of alkali compatible with profitable cultivation. The change could doubtless be easily accomplished by interposing, at suitable points in the ditches, sluice boxes filled with coarse fragments of gypsum, renewed from time to time as the action of the water converts the gypsum into carbonate, or common limestone. Or, the gypsum may be applied to the soil itself, and thus be made to neutralize not only the soda of the irrigation waters but also that in the soil itself, at the same time introducing a useful fertilizer. The amounts to be thus used effectively may vary, according to circumstances, from 200 to as much as 1,000 pounds for the first application; smaller doses to be used thereafter at such intervals as experience may dictate.

Precautionary measures of this character should be employed as soon as possible by the inhabitants of the fertile valley of Kern River. Those using its waters should keep in mind that their evaporation adds annually to the alkali already in the soil a small but not inappreciable amount, which in some cases may, after a few years, prove "the straw that breaks the camel's back;" and that, therefore, some of the means mentioned above as remedies against this kind of alkali especially should be currently employed to keep it in abeyance. Tillage after irrigation, the planting of deep-rooted crops instead of grain, and the use of gypsum as a neutralizer of the worst ingredient, the carbonate of soda, are the measures that suggest themselves as the most feasible; while sub-irrigation, and especially the leaching out of the alkali from time to time by long-continued flooding and underdrainage, are more radical remedies for future use.

The water from Point of Timber offers some interesting points, suggestive of a state of things that may have to be taken into consideration in all plans for the irrigation of the west side of the San Joaquin Valley. From its location, this water might have been conjectured to derive its ingredients from tide-water percolating into the loose strata. So far from this, its composition is closely analogous to that of the water of Tulare Lake, except that the proportion of carbonate of soda is considerably less, and therefore it is not likely to be as injurious in its effects on vegetation. Yet the inhabitants report here, also, that to irrigate with it "kills the soil," *i. e.*, renders it unproductive. It will doubtless do so when applied in small quantities only, and repeatedly. But it is likely that if used as suggested in the case of the Tulare water (that is, so as to leach the alkali out of the soil once in a season, into the underlying water-table), it might be successfully employed for irrigation, especially if, at the same time, the carbonate of soda were neutralized by the use of gypsum. If it be thought too fanciful to suppose, as has been done, that the alkali-water stratum at Point of Timber represents the seaward seepage of Tulare Lake itself, it is nevertheless quite probable that it does represent the quality of the underground drainage of the west side of the San Joaquin Valley, and is connected with the persistent appearance of "alkali spots" at every low place in the valley, from Antioch up to Kern Lake.

With the lights now before us, it can hardly be regretted that the old Westside ditch, which was to irrigate the lower country with the corrosive waters of Tulare Lake, was not successful. The lake level is now several feet below the bottom of that outlet, and the lake keeps receding annually, and its alkali becomes stronger as the mass of the water decreases. It is difficult to say where it will stop; but if, as is probable, a state of equilibrium is reached whenever the waters of Kern and King's Rivers shall have fully filled the parched depths of the plains by a more general system of irrigation, it is not at all probable that the lake water will thereby become fresher; on the contrary, such seepage water will be likely to bring into it the alkali now dried up in the lower strata, and the annual evaporation will concentrate the solution more and more. It would certainly be most desirable to utilize the lake as a great reservoir for irrigation supply. But to render this practicable, it would be necessary first to empty out or displace the mass of alkaline water at present occupying the basin. The discussion of the feasibility of such an undertaking, however, belongs to the province of the Engineer Corps.

From the facts above given regarding the alkali soils and irrigation waters of California, the importance of investigating thoroughly not only the quantity but also the quality of the waters available for irrigation in the arid regions is sufficiently obvious. The facts as nature has made them should be elicited and plainly set before the people, so that money may not be invested in useless undertakings, or damage done which it may be difficult to undo thereafter. There are, probably, but few river waters in the world of such composition or natural purity that continued irrigation without correlative underdrainage, can be practiced without in the end causing an injurious accumulation of soluble salts in the soil. In India, according to the testimony of Prof. George Davidson, the evil effects of such practice have become painfully apparent, and to such an extent that after the expenditure of enormous sums for bringing the water upon the fields, the government now finds itself face to face with the costly problem of its economical removal, by drainage, so as to relieve the soil of the accumulated "alkali," which has rendered it unfit for cultivation. An early attention to this matter, with such foresight as will prevent the occurrence of similar difficulties, cannot be too earnestly recommended to all interested [illegible]ds needing irrigation, from the Pacific coast to Colorado and

THE FIELD CROPS AND ANIMAL INDUSTRIES OF THE PACIFIC COAST.

By T. C. Jones.

The commission is directed to make observations, and to report upon the agriculture, horticulture, and live stock industries of those portions of the territory of the United States lying west of the Rocky Mountains and the arid regions, with a view to furnishing data to aid the department in determining the needs of these industries in the regions mentioned.

In this paper it is proposed to deal first with the agricultural methods prevailing, including cereal crops, their value, amount in aggregate, and average yield per acre, the general management of the land for agricultural purposes, and the methods of fertilization.

CEREAL PRODUCTIONS IN CALIFORNIA.

The chief cereal crops are wheat, barley, and oats. There is but a small portion of the land in California, south of the northern tier of counties, that will produce paying crops of Indian corn without irrigation. In some of the valleys of the Coast Range of mountains, north of San Francisco, we saw fair crops of this grain growing where there had been no irrigation, and on some of the low lands near Marysville and in the neighborhood of San José. The lands upon which these crops are grown are mostly of the character here called *adobe*, the soil being black and fertile and having a large percentage of clay mixed with the humus. In essential characteristics this land resembles much of the low plain and prairie lands of Ohio, Indiana, Illinois, &c., and like them it dries up in summer, and its surface is checkered by cracks which remain from early summer until the soil is opened by the autumn rains. But these tenacious soils are more difficult of cultivation here than similar soils in the Mississippi Valley in the same latitude, because they are not subject to the ameliorating frosts of winter which there penetrate to the depth of from 12 to 30 or 36 inches. The beneficial effect of this hard freezing in rendering stiff clay soils friable is well known. In California, therefore, the work of plowing these adobe soils has to be done in early spring or postponed until the autumn rains set in, usually not earlier than the middle of November.

The work of seeding is then pushed on as rapidly as possible, as the sooner the wheat is put in the ground after this period the better. The general practice has been to sow wheat after wheat, and for some years it was argued that this might be continued indefinitely without exhausting the land, and the practice is still continued by many cultivators. In the friable, sandy lands of the San Joaquin Valley it is a common practice to sow wheat on wheat stubble, simply harrowing it in, without plowing, and in some instances without sowing fresh seed, the waste wheat on the stubble being regarded as sufficient. But intelligent farmers, who carefully observe the results of their cultivation, are very generally of the opinion that this practice, which seems to have originated with capitalists who have embarked in wheat growing as a speculation, as Southern planters have in the production of cotton, is seriously detrimental to their lands—first, because under this practice the land soon becomes full of noxious weeds, and second, because it has been found to be slowly but steadily deteriorating in fertility.

Hence the best cultivators recommend what they call in California summer fallowing, though it is wholly unlike the cultivation so designated in the Eastern States and in Europe. The land is broken up in spring, say in March or April, when the soil is in proper order, and then left without further cultivation until the latter part of August, when what is here called *dry seeding* begins, the wheat being sown broadcast and harrowed in. All this work is done in a sort of wholesale and hurrying manner, as if the main purpose was to see how much could be done in a day with the least number of men. The breaking up is done with the gang plows drawn by four to six horses, and the rotating seed-sower is put on a wagon and so attached as to be operated by motion of the wheels. The harrow, which is more than double the width of those used in other parts of the country, is drawn by four and sometimes by six horses. In this way from 15 to 25 acres a day are sown. This is the cultivation found in the great valley of the Sacramento and San Joaquin, extending a distance of no less than 350 miles from north to south, and containing about 14,000 square miles—a vast level plain, mostly dotted over with native oaks, which, with their low and expanding branches and evergreen foliage, make this region one of enchanting beauty, and it is of extraordiary fertility for the production of this great world-recognized standard cereal. Nowhere in the world, probably, is wheat produced with so little labor or of such uniform excellence.

A remarkable peculiarity of the grand trees seen in almost all the fertile valleys of California is, that they seem to interfere very little with the growth of crops under their wide-spreading branches, which we suppose must be attributed to the fact that the roots run perpendicularly down into the soil in search of moisture, instead of spreading out near the surface, and thus destroying the vegetation within their reach. A large proportion of these countless thousands of acres are uninclosed, and we see, as we ride over the wide expanse, but few buildings and very little stock—a few pigs to pick up the wheat which is dropped from the over-ripe heads as the grain is harvested, and only the horses required to get in the seed and to reap the crops. We saw no reapers and binders, no wheat drills or horse-power threshers. The crop is cut with a header, which is propelled by four to six horses placed behind it. The grain is cut high, leaving 2 to 3 feet of the straw in the stubble. The header cuts about 18 feet in width, is managed by two men, and requires three wagons with four horses each to haul the grain from the header to the stack, with, of course, one hand to each wagon and two at the stack, say, in all seven men and twelve horses, harvesting perhaps 30 acres per day. The expenses would be, say, seven men, at $2.50 each per day, $17.50, which with teams, wagons, and header will make a total expense of $25 to $30 per day, besides board. There is no question about the capacity of these lands to yield large crops of wheat, where there is proper cultivation; but, as already observed, the methods of cultivation are peculiar, and when the work is carefully done it is far from [illegible]est, or what in older countries would be called good.

[illegible]g this negligent management, there are, in average years, many large tracts yielding enormous crops, say from 30 to 40 bushels per acre. But the average yield is below the usual estimate of the inhabitants, who generally insist that the Sacramento Valley will average 25 to 30 bushels per acre, while the most reliable, practical farmers informed us that even in the upper part of this valley, where deficiency of moisture to make the crops is rare, and where the quality of the land is of the highest excellence, 20 bushels is a fair average, one year with another, with what they call good cultivation.

By the department report for 1879 it appears that the total acreage under wheat in the State of California was 2,500,000 acres, and total yield 35,000,000 bushels, or an average of only 14 bushels per acre. In 1877 the yield was still lower. From 2,315,789 acres in wheat there were but 22,000,000 bushels reported as the product, while the yield of 1876 is put down at 30,000,000 bushels from a total acreage of 2,307,692. These yields, as compared with those of other portions of the Union, are not large, and certainly far below what California is capable of producing on the same acreage under a better system of husbandry.

Of the grain crops of California, the next in importance is barley; the acreage in 1879 being 630,500, and total product 14,501,500 bushels. For the same year the oats crop amounted to 5,072,000 from a total acreage of 153,700, or an average of 33 bushels per acre.

The same year 100,500 acres in corn produced 2,814,000 bushels, or an average of 28 bushels per acre.

The total value of these several crops for the year 1879 was:

	Total.
Wheat, per bushel, $1.23	$43, 050, 000
Barley, per bushel, 56 cents	8, 120, 840
Oats, per bushel, 67 cents	3, 398, 307
Corn, per bushel, 79 cents	2, 223, 060
Total value of cereals	$56, 742, 207

This comparison of the cereal crops of the State accounts for the prominence of the wheat products in the agriculture of California, though the exceptionally fine appearance and high quality of the grain have much to do in establishing the reputation of this great coast State as a wheat-growing country.

Comparing these products with some of the States in the valley of the Mississippi, we have striking illustrations of the vast difference in the productive capacity of our soil and climate in different parts of the country in nearly the same latitudes.

Thus, Illinois reports for 1879 a product of—

	Bushels.	Acres.	Value.
Wheat	44, 896, 830	2, 400, 900	$48, 039, 608
Corn	212, 221, 000	4, 088, 500	96, 788, 310
Oats	47, 670, 400	1, 489, 700	12, 071, 008
Barley	575, 000	25, 000	339, 250

ANIMAL INDUSTRY.

Before proceeding further to detail the methods prevailing in the cultivation of cereal crops, it will be convenient to state briefly our observations upon the animal industry of this region—its condition, management, value, etc., as required by our instructions—because, in our view of the matter, the condition of this industry has a very material bearing upon the profit of the business of growing crops.

wild oats, cut a little green, while the grain is in the dough. But as upon the farms (or ranches, as the people here, *in defiance of the usages of civilization*, persist in calling their farms), horses are seldom kept in stables. There is, therefore, from this branch of stock breeding but very little manure made to aid in maintaining the fertility of the soil.

We add in reference to this department of animal industry of California, that we are convinced that in average excellence for general use, the saddle and road, and the farm, the horses about the cities and in the central part of this State are not surpassed by those of any country with which we are acquainted.

In Great Britian the coach horse and the hunter, that were found in such excellence forty years ago, are now sadly depreciated in size and character. Breeding in that country is now chiefly confined to two classes of horses, to-wit, the race-horse, for short distances and light weights, and the heavy draft horse. It is the same in many parts of our own country, with the addition of a strain of trotting horses, bred almost exclusively with the view to mere speed, in an unnatural and unprofitable pace, for the race-course. We were, therefore, glad to see on the Pacific coast such a grand class of useful and stylish general-purpose horses, when horses of this sort are so generally deteriorating elsewhere.

CATTLE.

"No cattle, no corn," is an old English maxim, and when the inquiry was made as to how much corn a farm would produce, it was common to answer "that depends upon how many cattle you keep." Cattle and sheep, it was assumed, must be kept on the farm to make manure, and, according to the English notion, this stock, to be of any benefit to the land, must be well kept, for it was said "if the cattle are fed straw, the manure will be straw, the crop will be straw, the farmer will be straw, and all will be straw together."

The department report puts the number of milch cows in California in January, 1880, at 473,400; average price at $28.65, which is about $2 per head higher than Ohio, Illinois, and Michigan, and $6 higher than Kentucky; while the cows in Oregon are valued in the same report at less than $18 per head.

But "other cattle" in California are valued at only $18.47 per head, while in Ohio they are $22.37, Illinois $21.09, Kentucky $19.05, and Oregon $11.39.

By the report of the California Board of Equalization for 1880, compiled from reports of county assessors, the average value of cattle is put at $10.39 per head.

Six hundred and thirty-eight thoroughbred cows are valued at an average of $56.82 per head, and 111,846 "American cows" are put down at $19.59 per head, and 72,938 "graded cows" at $18.94 per head; 96,055 calves are valued at $4.91 each, and 4,419 oxen at $30.95; 12,966 beef cattle at $18.45.

These conflicting valuations do not furnish reliable data for determining the value or condition of this class of stock in California.

From our own observations we should conclude that the reports of the local assessors as to the number of thoroughbred cattle in the State was very far below the actual total of even the counties therein reported, if the report includes full-blooded cattle of all the different breeds, as Shorthorns, Jerseys, Herefords, Devons, Dutch, Ayrshire, &c.

The house of Miller & Lux, of San Francisco, is believed to be the largest breeding and meat-producing establishment, probably, in the United States, handling stock of equal excellence. This firm alone has no less than 500 full blooded shorthorn cows and heifers of all ages, besides large numbers of grade Durhams among the 22,000 cows they keep for breeding beef cattle; and about 250 high-grade cows, having all the characteristics of full-blooded Shorthorns, on a dairy farm of 600 acres, part of an estate of about 40,000 acres they own in the Santa Clara Valley, near Gilroy.

For this farm of 600 acres, and the use of the 250 cows, the tenant (Mr. Davis, a very skillful dairyman) pays an annual rent of $4,500, besides all the calves at the age of four months.

The product of this dairy in 1880 was $17,000 worth of cheese; also made about 60,000 barrels of pork.

Miller & Lux have in all about 700,000 acres of land, situated in the counties of San Mateo, Santa Clara, Merced, Fresno, Tulare, Monterey, and San Benito. These lands are nearly all inclosed, and the cattle and sheep of this firm are only allowed to run out on the plains in spring and summer until grass dies—say, till the middle of August. They estimate 5 acres of this land sufficient to graze a bullock through the year.

This house gave us prices as follows: Veal calves at three to eight months old, $8 to $12 per head. The cattle they purchase at three to five years of age, generally in Nevada, cost about $25 per head. These cattle are mostly bred in Oregon. Hides of bullocks sell for about $7 each, and of cows for $4. Beef in dressed carcass sells from $4.50 to $6 per hundred. Mutton, dressed carcass, $3.50 per 100 pounds. Bullocks weigh about 600 pounds net, sheep (wethers), say, 50 pounds, and ewes 45 pounds; calves about 200 pounds net. Dairy calves are killed young, say at four to six weeks, and sell for 8½ cents, average weight 75 pounds, and are mostly from counties of Maria and Solano, chiefly common stock, as dairymen in these counties do not use blooded bulls. August and September are the months when beef cattle are in the best condition; after this they begin to decline, and the great majority of California cattle become quite thin before the grass gets nutritious in spring.

On the Miller & Lux estate, in Santa Clara County, we were shown 160 Durham steers about three and a half years old, that were estimated to weigh 1,700 pounds, live weight, and they were of a character that would rank nearly first class in Eastern markets. These bullocks were on what was here called fair grass (October 13), but all dried up, and as they thought of little value, except a part that was in alfalfa, and this, they said, while much esteemed by some for dairy cows, was not very profitable grazing for beef cattle. These bullocks were being fed corn in the shock (small Yankee corn), with a daily allowance of pumpkins.

We were also shown a lot of Oregon bullocks, purchased in Nevada, about 150, three to four years of age. These were cattle of fair quality, but not in good flesh; weighing, perhaps, 1,350 pounds, average, and most of them showing indications of Shorthorn blood, as these gentlemen said was common with the Oregon steers. They cost $27 per head, and would have brought in Chicago double that money, and in the spring of the year a good deal more.

It seemed strange to us to see cattle of this size and quality in such lean condition at this time of year, and appeared to indicate that they had been on very indifferent grass.

THE DAIRY.

Our observations in regard to the dairy interests of California may be appropriately given here.

The cheese dairy on the estate of Miller & Lux, in Santa Clara County, has already been referred to, as showing that this industry is one of the most profitable connected with the agriculture of California. But this establishment is well managed, the cows being grazed largely on alfalfa and fed wheat bran and shorts, oil cake, middlings; corn and pumpkins being fed to pigs. Cost of bran and shorts averages $14 per ton.

There are about 3,000 cows in dairy in this part of the Santa Clara Valley, that is, near the town of Gilroy, making annually, as we were told, about 1,000,000 pounds of cheese, which, according to our observation, is mostly of good quality.

The valleys of the Coast Range of mountains are believed to be well adapted to this industry; the pastures being better and lasting longer than in the great valleys of the Sacramento and San Joaquin.

Many of the dairymen here, perhaps most of them, do not feed their cows, and these count May and June to be their best months, during which time the cows make very large returns on the native grasses. The counties producing the largest amount of cheese are all in the Coast Range region, to-wit, San Luis Obispo, 786,552; Sonoma, 500,000; San Benito, 350,000; Santa Clara, 88,795; Marin, 68,318; Los Angeles, 55,000; Monterey, 55,000; and the largest amounts of butter are produced in the same region, to-wit, Marin County is reported as producing no less than 3,468,680 pounds annually; Sonoma, 3,000,000; San Luis Obispo, 1,135,126.

There are also good grazing lands in some parts of the Sacramento and San Joaquin Valleys, where the dairy industry is pursued to some extent. Thus we find Tulare County produced 443,850 pounds of butter, Sacramento 385,000, and Yolo 200,000 pounds.

The cows used in these dairies are mostly such as are seen in many of the Eastern States, or what is called common or unimproved stock. In the Santa Clara Valley there is quite an infusion of Shorthorn blood, as in some of the counties in the Sacramento Valley and in other parts of the State. The reasons given for this preference for this blood, are that the half-bred Shorthorns are generally good milkers, and always produce good calves to rear, either for beef or milk, and the cows themselves, when no longer wanted in the dairy, always make more valuable carcasses of beef than milking cows of any other breed. In many dairies, however, we observed some cows of Jersey blood, especially those in the neighborhood of the towns and cities.

In the Santa Cruz and Pescadero region there are perhaps nearly 5,000 dairy cows. Some of these are grade Ayrshires and some grade Jerseys, with a few Devonshires. On one single estate, that of Mr. Laird, we learned there were about 200 full-blood Shorthorns.

There seems quite a spirit of improvement among the cattle-breeders of this part of the State, especially those engaged in the dairy business, who are resorting very largely to pure blood, mostly to the Jersey and Shorthorn; the latter, as we learned, being most in demand, because they are believed to be superior for beef and cheese, and they regard cheese as much more profitable than butter. The Ayrshires are esteemed as excellent milkers and good for both butter and cheese.

It is the common practice at these dairies to save fifteen to twenty per cent. of the heifer calves to supply the places of the aged cows that are annually drafted for slaughter.

We have already observed that the report of the State board of equalization of California, giving the number of thoroughbred cows in the State as only 628, must be grossly erroneous, and have shown that the single firm of Messrs. Miller & Lux must have more than half that number of thoroughbred Shorthorn cows in milk, and that Mr. Laird, in Santa Cruz County, has nearly 200 of the same breed.

Mr. Robert Ashburne, an Englishman, who occupies 700 acres of land near Baden, in San Mateo County, has nearly 100 head of pure Shorthorns, a considerable portion of them being imported by himself. Half of this herd must be breeding cows; and we suppose Colonel Younger, of San José, whose herd numbers about 60 head, has 30 or 40 cows. This would give a larger number in the herds of these four proprietors of this single (Shorthorn) breed than the report gives of all the pure breeds in the whole State.

As to Shorthorn bulls, they are to be found in all the cattle-breeding districts in California and Oregon. Messrs Miller & Lux, we believe, have 250 to 400 in service. Many of the dairies use these bulls, and sell the bull calves to the ranchmen who are breeding cattle for beef.

We have not been able to find any reliable statistics as to the proportion of the cattle of California that are improved or "graded" stock. It appears to have been the purpose of the State authorities to obtain this information from local assessors for the use of the State board of equalization in 1880. But, as already stated, these returns seem to be exceedingly defective, so defective, in fact, as to be of little value.

The total number of cattle of all sorts, according to these returns, we make only 622,874, and this includes 96,055 calves, while the United States Agricultural Department report for the same period puts the number at 1,472,100.

Many of the local assessors omit to give the number of cattle in their counties, and a note to the report of these statistics made by the State board states that only the assessors of Butte, Shasta, and Monterey "seem to know what *graded* means, being a term used by stock-raisers to indicate the produce of a thoroughbred sire and dam of unimproved blood."

We do not indorse this definition. When stock-men speak of grade cattle, grade sheep, &c., they mean stock that has been improved by an infusion of the blood of some established breeds. The sire may be purely bred or half bred, or the dam may be a full blood and the sire a scrub, or both sire and dam may be half bred, or grades. In either case, or whatever the proportion of pure blood, where the progeny shows in any degree the characteristics of the superior blood, it is called *a grade*, and where there is a predominance of the pure blood, as seventy-five per cent., which would be the result of two crosses, the animal is called a *high grade*. Some years ago there was a distinction made by breeders in some parts of the country between animals called "full bloods" and those denominated thoroughbreds. Four crosses of pure blood were held to constitute full bloods, while "thoroughbred," as applied to cattle, implied a descent in all the crosses from imported animals of the pure breed.

In Great Britain, the term "thoroughbred" is applied only to the *race-horse*. There all Shorthorn cows are admitted to register in the herd books that have four crosses of recorded bulls; and bulls are required to have five such crosses to entitle them to rank as well-bred Shorthorns.

The reports of the local assessors show the proportion of unimproved, or "American" cows, as they are here designated, to the "graded" cows to be one hundred and eleven to seventy-two, and we believe from the observations we were able to make that the spirit of improvement among the breeders of cattle in California is quite general.

But the system of feeding and management of this most important class of farm stock, so far as respects its influence upon the productiveness of the soil, is about as bad as it can be, if we except a portion of the dairies, and a few herds of blooded cattle. The stock, as a rule, is without shelter throughout the year, which, on account of the wonderful mildness of the climate, is not injurious to the cattle. But with the large majority there is no feeding, summer or winter, or pasturing on cultivated grasses. Such grazing as the native forage plants yield is really of what may be denominated high excellence, but only during a small portion of the year, as we were told by the most reliable and practical graziers, not exceeding in average years four months. The native grasses and plants begin to grow, say in the latter part of November or beginning of December, but contain, as we learn, little nutritive value before April, and by the latter part of July they are mostly dried up and withered. Upon this dried forage, with the fat-producing seeds of some of the plants (as the bur-clover), the cattle subsist until, say January, and from that time to April upon the new grass that has started up from the seed since the rains. The consequence is that a large majority of the stock is found to be very low in flesh before the good grazing period arrives.

It is stated in the valuable work of Mr. John S. Hittell, entitled "Resources of California," that—

> Nineteen out of twenty of the cattle of California never get any food save such as grows indigenously with the open country, and they always suffer for it. From March to July the pasture is abundant and excellent, and the cattle are fat from July to October in ordinary years The grasses and clovers, though dry and brown, are nutritious, and the cattle still remain in good condition; but from October to January they grow lean rapidly, and almost every year a considerable number die by starvation. In 1856 70,000 head died in Los Angeles County alone by starvation, one-third the entire number in the county, which has now (1879) but 27,000 in all. In 1863 and 1864 the loss by starvation was estimated at 200,000 to 300,000.
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> In the spring of 1863 Santa Barbara County had 97,000 head, and only 12,000 head in the spring of 1865.

EFFECT OF THIS SYSTEM UPON THE STOCK, AND BEEF AND DAIRY PRODUCTS.

As stated by Mr. Hittell, during this period, from March to July, the cattle are fat, or, more accurately, they become fat by the latter part of this period, and the rapidity with which fat is accumulated, say during the months of May and June, is extraordinary; but it is observable that the muscular system, so severely impaired during the long period of poor keep, is not restored, and therefore the cattle which are fat are not *fleshy*, and do not weigh as cattle of the same age and quality that are well kept through the year.

The fact here stated is clearly demonstrated by the appearance of the beef in every butcher shop, which, as a rule, in summer and early autumn, shows an unusual quantity of fat inside and outside the quarters. But in depth and thickness the lean flesh is surprisingly deficient, as it is also in what is called the marbled characteristic, that is, the mixture of fat with the lean, so essential to excellence in beef.

The quality of the beef produced under this system is moderately good. It is as tender as the flesh of the same grade of cattle in the Mississippi Valley, but it is not of high excellence in flavor, as might be expected from the character of the herbage upon which the cattle feed, which at the period of its highest excellence is, as wild grasses are generally found, without the agreeable perfume of the cultivated varieties.

It is well settled that grazing is essential to the production of the highest quality in juiciness and flavor, as well in mutton as in beef; herefore in Great Britain, the cattle that are intended to furnish Christmas beef for wealthy epicures, are "made," on grass alone, or in exceptionally severe weather in winter the cattle are allowed a little hay of he best quality. But they are never fed oil-cake or turnips, because of the supposed injurious effect upon the flavor of the flesh.

The same observations will apply to the products of the dairy, especially to the butter. California butter is sweet and well made. In no part of the country can less bad or rancid butter be found, or butter more generally well worked and properly salted. But with all this, it acks flavor—the high flavor of the Chester County (Pennsylvania) butter, or butter of other districts whose pastures abound in blue grass, white and red clovers, sweet-scented vernal grass, &c.

But we have observed a marked difference in the quality of these products when beef cattle have been fed corn, pumpkins, and the wild oats hay cut in proper time, and when the same, with carrots, beets, bran, shorts, &c., have been fed to cows and especially where they have had a run on what is here called Australian rye grass,* but which is really, we suppose, the same as the rye grass so generally cultivated in Great Britain and some of our Eastern States.

The alfalfa, too, so universally esteemed here, is beneficial in increasing the quantity of these products, though there is a difference of opinion in regard to its influence upon the *quality*, some insisting that it imparts an objectionable flavor to the milk and butter, while others insist that this is not the case. It certainly improves the color of the cream and butter.

INFLUENCE OF THIS SYSTEM UPON THE SOIL.

From what has been already said, it is obvious that the system of feeding and grazing cattle in California is most seriously detrimental in its influence upon the productiveness of the soil.

In the first place, the cattle, during a large portion of the year, subsist upon dry herbage, containing the most meager percentage of nutritious or fertilizing matter, so that if all the excrement were saved and applied in the most judicious manner, where it was most needed, it would be of very little value. But when we reflect that nearly all the cattle in California are out of doors day and night throughout the year, and a large proportion on ranges that are never expected to be cultivated, we see at once that the arable lands of the State, excepting those in a very few locations, derive but little benefit from the manure made by the large number of cattle (estimated at nearly a million and a half) now grazed in California.

SHEEP.

Wool-growing is one of the leading industries of the State. The department report of 1879 gives the number of sheep in January, 1880, as no less than 7,646,800. The average price is reported at $1.62, and total value at $12,387,611. This is largely in excess of the number found in any other State.

Texas, which ranks next, has 5,148,400; Ohio, 4,080,400; Nevada, Colorado, and Territories, 4,019,600. New York comes next with 2,205,800; Missouri, 1,523,200; Wisconsin, 1,316,100. The number in Oregon is 1,265,100, and the price per head only $1.46, while in Nevada, Colorado, and the Territories the price per head is $1.92. In Texas, $1.89; Wisconsin, $2.39; Missouri, $1.82; Ohio, $2.83.

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* More properly the Italian rye grass with longer spikelets than the English variety, which does not resist drought so well.—E. W. H.

The yield of wool, where sheep are fairly managed, from flocks of good grade, is claimed to be six to seven pounds per head.

Mr. Parks, of Marysville (speaker of the house of representatives), who owns about 10,000 head of sheep, informed us that the average yield was about 2½ to 4 pounds per head at the spring shearing (in April or May), and 2½ to 3 pounds at the September shearing.

Colonel Hollister, of Santa Barbara, who has 60,000 head of sheep, says he keeps them on 100,000 acres of land, shears but once a year, in April or May, and gets, say, 8 pounds per head in the dirt. Colonel Hollister drove sheep from Illinois in 1852; started with 6,000; came by southern route, and arrived out in fifteen months with 3,000 head; and this was the pioneer flock of well-bred merino sheep. Previous to this the sheep of California were only the coarse, native sort, that would not sheer over 2 pounds of wool, and make not more than 40 pounds of mutton. These sheep have only the native grass, &c. Colonel Hollister has no experience with cultivated grasses.

According to the testimony of these gentlemen and many other flock masters, the lambs are dropped from February to May, and a large percentage is lost on account of storms, &c. There is no shelter. Breeders insist that it would be impracticable to provide sheds.

Mr. Parks thinks the average proportion of lambs reared is about 600 to 1,000 ewes. A large portion of the sheep here are grazed upon the swamp or " tule " lands in summer, and upon the hills in winter. A wool grower keeping 5,000 head of sheep told us he was paying a land company in Los Angeles County three cents per head per month throughout the year for pasture. The range, he says, was better a few years ago than now; well stocked at that time with bur-clover and alfalfa, which are now giving place to fox grass and other inferior sorts.

Everywhere we observed that the large flocks were Spanish merinos, of which breed there are many breeding flocks of the highest excellence and of unquestionable purity of blood, equal, we think, to any found in the older States. We also saw some excellent sheep of the French merino sort, of very large size, with enormous fleeces of wool of the best quality. But the blood usually resorted to for the improvement of native flocks has been the Spanish merino, as bred in the wool-growing States east of the Mississippi, and we suppose there can be little doubt but this breed is better adapted to the system of sheep husbandry generally practiced in California than any other.

Southdown sheep are bred to some extent, and are favorably regarded. The long-wools have been tried, and Cotswold crossed on the merino are well spoken of. We notice by the report of the State board of equalization for 1880 that only 6,375 sheep are reported under the head of "imported or fine," by which we suppose is meant full-blooded of any breed, and these are assessed at a valuation of $603 per head, and only twelve of the fifty-two counties of the State have the credit of owning these well-bred sheep.

Wool is generally not in good condition, and while the price of wool as scoured here for shipment east is, say, 65 cents per pound, the price in the dirt is 16 to 24 cents per pound.

The product of the southern part of the State comes to market in much worse condition than the northern wools; and the fall clips, being shorter than the fleeces sheared in the spring, sell for one-fifth or one-sixth less money.

The average prices in the San Francisco market of wool from California and Oregon, for 1879, were as follows:

Varieties.	June.	October.
	Cents.	*Cents.*
Native	12½ to 13	12 to 15
California	16 to 25	16 to 26
Oregon	18 to 25	18 to 26

Cincinnati prices at same period were as follows: Unwashed combing, 25 to 26, and 27 to 28 cents. Showing that California and Oregon wools, making due allowance for the larger amount of dirt, &c., compare very favorably as to quality with those of the best wool-growing districts of the country, and this corresponds with our own observations on the subject.

We subjoin extracts from one of the excellent tables of statistics prepared and courteously furnished us by the cashier of the Grangers' Bank of California, Mr. Albert Montpelier, whose important services to the agricultural interests of the State, in the annual preparation of reliable statistics, are, we hope, duly appreciated by the farmers of California.

According to these tables the total wool clip of California for eleven years, that is, for 1870 to 1880, both included, was 423,701,154 pounds. Total value $78,652,830. The clip of 1880 is stated to be 46,074,154 pounds, valued at $10,136,313. The largest clip was in 1876, to-wit, 56,550,970 pounds. The next year was about four millions pounds less, while in 1878 the clip was only 41,402,509 pounds.

On the whole, it would appear that the wool product of the State has doubled since 1870. The prices as given by these tables for the past eleven years average a fraction less than 20 cents per pound.

From what has been said as to the system of sheep husbandry in California, we are forced to the conclusion that, as respects its influence upon the fertility of the soil, it is as unfavorable as any system that could be devised. But there is no question as to its returns being highly remunerative. If it be true that pasturage can be had to keep sheep the year through for 3 cents per head per month, we may assume that the cost per year, excepting salt, attention, and shearing, is from 35 to 40 cents per annum. The total, we suppose, as these large flocks are usually kept, could not exceed 50 cents, while the wool at, say, 20 cents per pound, and 6½ pounds per head, would give us for the fleece alone $1.50.

The value of the increase we shall not attempt to estimate. But if provision were made to guard against losses occasioned by storms and by failure of herbage, the value of this increase would be very great, as there is probably no climate where sheep are more healthy or more prolific.

SWINE.

California is not a hog-producing State, for the very obvious reason that these animals, for their prosperous growth, require corn and clover, which are cultivated here only in exceptionally moist localities, and to a very limited extent.*

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*Excellent crops of corn are often produced on the coast, even when it has been planted after the cessation of the rains, and there is no obstacle to planting it six weeks earlier. The chief reason why it is not grown more abundantly is the limited demand, inasmuch as the temperate winters do not allow of pork packing to advantage. The latter industry is left to Oregon, and the production of pork in California, outside of the mountain districts, is practically confined to supplying the markets with fresh pork. One of the most extensive corn and pork growing districts in the State is the coast region of Ventura County, and the valley of the Santa Clara, lying back of the same—the Saticoy country.—E. W. H.

According to the department report for 1879, the number in the State in January, 1880, was 661,000; average price, $3.97. In Oregon the number was 228,500; average price, $2.60. In Nevada, Colorado and the Territories, the number is 170,000; average price, $6.97. We do not understand why hogs are so dear in the mountain States and Territories. We suppose the expense of growing them must be very high.

Kansas had, at the same period, 1,208,700 hogs, valued at $5.28 each. According to the report of the surveyor-general for 1880, Butte County had more than four times the number of hogs reported for any other county in California, the number being no less than 101,500, while the next highest, Los Angeles, had only 18,990, and Tulare and Sonoma had each over 18,000. Excepting Tulare, each of the above counties produce considerable crops of corn—Sonoma, 1,000,000 bushels; Los Angeles, 800,000 bushels; and Butte, 70,000.

QUALITY OF HOGS.

The hogs of California, so far as our observations extended, appeared to be of good blood and quality.

The breeds most in favor are the Berkshire, the Essex, and the Poland China, here called simply *China*, a designation certainly quite as accurate as the Poland China, first applied by a few speculators in the Miami Valley, in Ohio, where this excellent variety of swine originated from crossing the China hog with the Frazier, Berkshire, &c., but there is, we believe, no authority whatever for the assumption that the blood of any Poland breed was ever used in the Miami Valley, or elsewhere in Ohio.

The white hog is universally condemned in California; his skin does not seem to stand so much sunshine. Hence we found black the prevailing color in all parts of the State, and a large proportion are all black, like the Essex, and similar in form, though usually larger. But, as already stated, they are very generally of good quality. Of the long-legged, long-nosed and flat-sided sort, very few are to be found in California.

HOW THEY ARE KEPT.

Like all other stock here, the hogs are on the range or in open fields throughout the year. Those best cared for are on grain stubble or alfalfa pasture, and furnished with a little corn, pumpkins, and mill feed, and at the dairies they have the whey and buttermilk.

The alfalfa is very highly esteemed by many farmers for fattening hogs. Among other intelligent opinions of practical men we quote here that of Hon. T. B. Berry, of Sutter County, now Representative in Congress, who informed us that he frequently made hogs fat enough for market on alfalfa alone. This gentleman's farm is at the junction of the Yuba and Feather Rivers, where the lands are quite fertile and moist.

This branch of live-stock breeding is not increasing in California—is in fact much less now in proportion to population than it was in 1860, being then 600,000 against only 661,000 now.

GENERAL SYSTEM OF CULTURE AND METHODS OF FERTILIZATION.

In view of the account already given of the system of breeding and management of live-stock in California, it is scarcely necessary to add that in the great grain and stock growing districts *there are no methods of fertilization.*

The great and indispensable reliance of the farmers in all counties where advanced systems are practiced, is barn-yard manure.

It may be said that upon the great ranches where wheat is grown by the wholesale methods we have already described, there are few or no barns or barn-yards, and no manure heaps in store for the exhausted soil. Not only so, but it is not an uncommon thing to hear owners of these ranches argue that barn yard manure is useless in the climate of California; that it cannot be rotted, and if "plowed under will be an absolute detriment to the crops in dry weather." In San Mateo County we found Mr. Ashburne, the English tenant farmer, to whom we have referred before, with a large herd of first-class Shorthorns and a dairy, feeding his cattle in-doors, and saving all the manure, which was thrown into a manure pit in the barn-yard, as is the practice in England. From the pit it was carted off to the fields where roots and corn were grown to feed his cattle; the corn being mostly fed green, at about the stage the ears were forming, and sometimes when in roasting ears. And this practice, Mr. Ashburne assured us, was amply remunerative.

It should be observed that the manure pit is dug out in basin shape in the barn-yard, so as to hold the water falling in the rainy season, which, with the liquid excretions, furnished an abundance of moisture to rot the straw and other solids in the manure heap. The same economy was observed in the management of manure by some of the dairymen in Marin and other counties in the Coast Range.

We could not learn that any experiments had been made to fertilize the soil here, by plowing under vegetable matter, as practiced in many of the States. Common red clover could not be grown for that purpose in California, except in the extreme northern counties, in some of which the clovers, with timothy and orchard grass, are grown with profit, as they are in nearly all parts of Oregon; and in consequence, live-stock and dairy interests are rapidly increasing.

PRACTICAL AND SUGGESTIVE OBSERVATIONS ON THE AGRICULTURAL PRACTICE OF CALIFORNIA.

Assuming that the space the department is able to devote in its reports to the publication of the data furnished by this commission is limited, it has been deemed expedient to confine this paper to the leading agricultural products, the prevailing practice in the cultivation, the methods of fertilization, and the animal industry of the State; leaving grape culture and all the various branches of horticulture, as well as such results of scientific research as may be appropriately submitted in connection with the subject, for the other members of the commission. Understanding the object of the department in creating this commission to be to obtain data to aid in determining the agricultural needs of this portion of the country, my purpose has been to confine these observations to subjects believed to be most important to that end.

While the investigations have been as extended as circumstances would permit, and conducted with a thoroughness and impartiality that should assure confidence in the conclusions reached, we have here condensed into as brief a compass as possible the statement of the results of these investigations.

From this brief survey of the agriculture of this great Pacific State, it appears that its leading products are wheat, cattle, horses, and sheep, estimated by the Department Report for 1879 to be worth no less than *one hundred million dollars*, to-wit, wheat, $43,050,000; cattle, $32,031,053 horses, $12,607,140; sheep, $12,387,816; to which the wool clip would add, say, ten millions more, while all the other products, to-wit, barley, corn, oats, rye, hay, and potatoes, aggregate only $29,874,238.

As has been shown, the methods of cultivation practiced by wheat growers in California are indifferent enough, and very seldom such as will secure crops equal to the productive capacity of the land, besides being about as bad as can be in their influence upon the fertility of the soil. Nor are the systems practiced in the rearing and management of cattle and sheep any nearer the general standard of the advanced agriculture of the United States.

These wholesale and wasteful systems originated with the owners of large landed estates, which are more common here than in any other part of the country. The title to these estates was originally acquired by grants from the Spanish and Mexican Governments, and in many of the better counties of the State, more than half of the most desirable lands are held under these grants, which usually embrace five or six to twenty and thirty thousand acres each, and in some instances as high as forty to fifty thousand. Many of the proprietors of these large tracts insist that, in California, wheat cannot be grown on small farms at prices to compete with the wholesale methods practiced upon the large estates. But from the testimony of a very large number of the most intelligent and practical farmers of the State, and from a careful computation of the expenses of the different methods we are satisfied that this assumption is altogether erroneous. Among gentlemen of experience with large estates of the best wheat-growing lands, whose opinions were obtained on this subject, may be mentioned Hon. J. A. Bidwell, of Butte County, whose estate contains no less than 20,000 acres, and appears to be most admirably managed in all its departments, including all the standard varieties of fruits, with grain, live stock, &c.

General Bidwell states that with the large force necessary to employ at special seasons of the year, in the cultivation of grain by thousands of acres, besides the fact that the cultivation cannot be of the thorough character to insure the highest yield, there would necessarily be large losses resulting from the waste of time occasioned by various accidents occurring, and other causes which cannot be guarded against. There is also an unavoidable loss from neglect in taking proper care of tools, implements, and teams. Add to these items the great waste resulting from their wholesale method of harvesting the grain, and the fact that it cannot be done at the proper time, and it will be found that the methods elsewhere practiced upon small farms would give the most profitable results here also. Hon. T. W. Berry, member of Congress, residing in Sutter County, and Mr. Johnson, of Sacramento County, speaker of the State senate, and a large number of other practical farmers in different parts of the State, fully concurred in this opinion of General Bidwell.

But besides all this testimony we have the figures as to actual cost and receipts under this wholesale practice. The expense of the cultivation, harvesting, threshing, and hauling to store an acre of wheat, is about $10, as was generally agreed by the advocates of the wholesale system. I think the expense in Ohio, under our practice, would not exceed this sum. The average yield under this system would not exceed 20 bushels per acre, worth, say, $1 per bushel, which, it is claimed, would give $10 per acre for the use of the land and the interest on other capital employed. But under this practice it is admitted that the soil is failing in productiveness, and that all the best farmers allow half their land to lie in fallow every year, which would give, in fact, only $5 return per acre for the land and other means invested; and the rents of good lands are lower than this, say $3 to $5 per acre. But in addition to all this, we were led to believe from what seemed reliable information that, as a general rule, the men who were farming these large tracts were in debt, some of them to very large amounts, and the opinion seemed very general that the business was hazardous; while the farming on smaller tracts was always safe, and the proprietors almost universally in prosperous condition.*

Assuming that under the prevailing system of wheat growing in California, the soil is steadily decreasing in fertility, it would seem obvious that the enormous and constantly increasing area of the best land that is devoted to this crop cannot be otherwise than detrimental to the agricultural prospects of the State.

Notwithstanding the favorable conditions of the soil and climate for the production of large yields of the best qualities of wheat, there are some unfavorable conditions connected with this industry that are peculiar to the locality. The first is the distance from market, the enormous cost of transportation, and the time required between the shipment and the receiving of returns from the sale. Then we are to add to this unfavorable circumstance, as affecting the price of grain in the hands of the producer, the fact that the population, as compared with most of the other large wheat-producing States in proportion to the aggregate product, is far below the average; so that the home consumption is exceptionally small.

In 1880, while the population of California was 854,686, we find its wheat crop reported at 29,017,769 bushels; and Iowa, one of the largest and best wheat-producing of the new States, with a population nearly double that of California, reports for 1880 a crop of only 31,154,205 bushels; while in 1878 the crop in Iowa was reported at 30,440,960, and that of California at 41,990,000.

It is scarcely necessary to add that the California cultivation under the conditions above noticed is unfavorable to the increase of the rural population, and indirectly to that of towns and cities as well. From all which it seems plain that the most important of the needs of the agriculture of California is—

A GREATER DIVERSITY OF PRODUCTS UPON THE FARMS.

Whenever a change of practice in this direction is established, two results of the highest importance to the welfare and prosperity of the State will follow. First, a more rapid increase of population, especially in the rural districts; and, secondly, by the establishment of such a practice, with its indispensable feature of *rotation of crops*, the deterioration of the soil will be arrested and the foundation laid for the permanent maintenance of its fertility.

What are the changes required in existing methods to bring about this diversity of crops? In large measure, only to bring into general use methods that we find practiced in exceptional cases in every quarter of the State. An intelligent and industrious farmer on an estate of, say, one to five hundred acres, with suitable buildings, including barns and proper shelter for stock, the farm to be properly fenced and stocked with cattle, sheep, horses, pigs, and poultry, one-fourth to one-half of the land may be in grain—wheat, barley, oats, and corn—if the situation is favorable.

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*A very heavy item of expense to the large-scale wheat grower, not mentioned above, is its heavy prime cost, as well as wear and tear of the agricultural implements and working stock, of which, under the peculiar conditions of the California climate, especially the rapid maturing of the grain toward the end, there must be an unusually large plant in proportion to the area cultivated. Even thus there is a very heavy loss from the shelling of wheat, as is shown by the habit of "volunteer crops" the second year; and any accident to a header in harvest time involves a severe loss in many ways.—E. W. H.

The farmer should grow, and can profitably grow, in any part of California, all varieties of vegetables needed for his own use; and if near markets, beets, cabbages, and potatoes may be profitably grown for sale. If planted at the proper time, and given the proper cultivation, good crops may be always expected. I do not refer here to the highly important horticultural industries of this State, further than to say that any farmer, under the exceptionally favorable conditions existing here for fruit-growing, should always produce, at least, a supply for his own family use. The rest of the land, after a proper allowance for timber, where practicable, should be devoted to grazing and the production of hay. It will be said by many that cultivated grasses, clovers, &c., cannot be grown in California, except in particular and limited localities. But I reply that there are abundant and incontestable facts establishing that in nearly every portion of the grain-growing districts, alfalfa can be and is profitably grown. It is valuable, as well for hay as for pasturage, and for all kinds of stock, including swine. Its cultivation is not more difficult or expensive than that of the common red clover, and it is probably as valuable as a fertilizer and as a restorer of exhausted soils. In many localities we have seen the rye-grass grown with the most satisfactory results. The variety here cultivated is called Australian rye-grass (*Lolium Italicum*). It is excellent for pasture, and makes the best of hay. It is, we believe, increasing in public favor here, and I have faith that it can be grown in many districts where it has not yet been tried, without irrigation. *With* irrigation, it will flourish in any part of the State. We could not learn that Hungarian grass (*Panicum germanicum*) had been tried in any part of the State, but see no reason why it could not be profitably grown here. It is an annual, producing a large quantity of seed, and germinates readily, and withstands drought wonderfully, remaining green when other grasses are dried up. It is a very rapid and rank grower, and does well on light clay soils. There can scarcely be a doubt but it would make a large crop of hay in almost any part of the State, if sown in early spring, without irrigation. A crop of this grass, after wheat, would clear the ground of weeds, and furnish what the English call a *shift*—a change of crops so essential to the maintenance of the fertility of the soil. After taking off the hay, the ground could be plowed for wheat in the autumn, and fertilized by the immense mass of fibrous roots which this grass sends into the soil.

The alfalfa would be still better as a renovator and fertilizer, and would be as profitable in the hands of a skillful man on a farm properly stocked with well-bred cattle, sheep, &c., as a grain crop, and would be followed by such an increased yield of grain, when the land should be again brought under tillage, that the result of the "shift," besides the benefit to the land, could not be otherwise than highly remunerative.* And so the farmer under this system of mixed husbandry would be furnished at home with every agricultural product consumed by his family, or necessary for the subsistence of his stock. Instead of the system so generally practiced here, of selling everything that is grown upon the farm, and buying everything that the family consumes and a large portion of the feed for the teams, &c., there would be sold as *little* as possible of the crops in the raw state, converting, where practicable, the wheat into flour, the grass, barley, oats, roots, &c., into beef, mutton, pork, butter and cheese, and growing large fleeces of wool of the highest quality and in nice clean condition instead of the inferior, burry, and harsh and brittle staple so often grown upon *the ranges.*

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*One obstacle in the way of the proposed use of alfalfa in the manner suggested is the great difficulty of extirpating it when the land is once thoroughly stocked with it. Even with deep plowing it will reappear among the grain for several years, after turning under.—E. W. H.

This change of methods would also improve the quality of the beef and mutton; the flesh would be thicker, more juicy, and of improved flavor, and worth more money, as would also the milk and butter. Sheep for wool would still be kept upon the ranges that are not suited for cultivation; while improved mutton breeds would be kept in moderate numbers upon the well cultivated farms. And upon such farms the best and most profitable breeds of cattle, horses, and swine would be reared because these would soon be found to pay best under the improved system.

How, it may be asked, are the best agricultural districts of the State, where so many large estates are now held, to be converted into farms of moderate size as here proposed? The answer is, that so soon as proprietors become convinced of the necessity and practicability of the change in methods of cultivation, they will undertake to bring it about; and experience will teach them that it will be more profitable for them to divide up their estates into farms of convenient size, and either sell them or let them to good tenants, on long leases, than to undertake the management of "ranches" of such enormous magnitude, under the improved system of husbandry.

OTHER ADVANTAGES THAT WILL RESULT FROM A CHANGE OF METHODS.

The future prosperity of California must depend largely upon its agricultural population. Where the farmers' holdings are of moderate size, the work is done in large measure by himself and family; the men or women that may be hired are brought into intimate relations with the proprietor, and not regarded as inferiors. In such a community society is not divided into distinct classes of proprietors and laborers, as is the tendency in all countries where lands are cultivated in large tracts. It is not to be supposed that the liberal and patriotic landholders of California will be indifferent to considerations of this character, so directly affecting the welfare of the great commonwealth of which they are proud to be called citizens. Nor will they be unmindful of the beneficial influence of this diversified agriculture, in elevating the intelligence and promoting the happiness of the cultivators of the soil.

MISCELLANEOUS FIELD CULTURES.

By E. W. Hilgard.

COTTON CULTURE IN CALIFORNIA AND ARIZONA.

Cotton has been more or less cultivated in California ever since agriculture took its place alongside the mining industry. Scattered patches of Mexican cotton were to be found in Southern California at an early date, but a home supply alone was the object of these. In 1868–'69 and succeeding years, energetic efforts to establish the culture on a large scale, and with improved seed from the cotton States, were made by the brothers Strong and others, in Tulare, Kern, Merced, and Colusa Counties, and the samples of these earlier crops remain to justify the statement then made, that the staple was of superior quality, both as regards length, fineness, and luster. The want of a market at home, and inability to compete with eastern cotton elsewhere, is apparently the sole reason why cotton has not, until quite lately, been counted among the regular and paying crops of California. A limited demand was maintained by the woolen mills for carding in with certain wools; and this demand was for four or five years supplied from three plantations in the bottom of the Merced River to the extent of from 400 to 500 bales per annum. Some agitation of the subject caused several experimental plantings to be made in 1880. Among these one of about 70 acres on Belleview ranch, near Bakersfield, in Kern County. The success of this, at least so far as quality was concerned, having called attention to the subject, plantings were made in other parts of the State also; among others one of 500 acres at Williams Station, Colusa County, and an experimental half acre in the bottom of Feather River, in Butte County. These two plantings in the Sacramento Valley are of especial interest, because the plant was grown without irrigation and with only a light spring shower after planting; therefore, practically without either rain or irrigation, while in the case of the plantations in the San Joaquin Valley, two irrigations at least have been used. The planting made in Butte County gave an excellent result both in quality and quantity, it being said by good judges that it would have yielded at the rate of 2 bales per acre. The 500 acres in Colusa County were a failure in so far as the variety planted was chiefly Sea Island, which had barely begun to bloom when the frost came. But a portion of the same field that had been planted in the uplands cotton, though much neglected, yielded a result proving that even there this crop would succeed under proper treatment, though far away from the river and in a heavy soil. Cotton has also for years past been grown at Chico by General Bidwell, merely for ornament, and has always fruited abundantly.

There can thus be little doubt that in a large part of the Sacramento Valley cotton can be successfully grown without irrigation, especially in the lighter alluvial soils near the rivers; while it is equally well established that with a moderate amount of well-timed irrigation, it is a paying crop in the San Joaquin Valley, always provided that a market for the staple can be found in California. The projected establishment of at least one cotton mill at San Francisco seems to promise that this state of things will not be long delayed; and, if so, it is probable that cotton will gradually encroach upon the area now planted in wheat, more especially where alkali prevails. As stated in the portion of this report treating of alkali soils, deep-rooted crops, requiring summer tillage, are especially well adapted to the utilization of such soils with the least amount of irrigation, while the wheat crop, especially when sown broadcast, is liable to suffer severely, both from drought and from alkali in the southern part of the San Joaquin Valley. For many reasons, it will before many years have to be replaced by crops admitting of summer cultivation, and less exhaustive to the soil. Among these cotton fulfills pre-eminently both conditions, for, as is now well known, the simple return of the seed to the soil will enable it to grow almost indefinitely without the use of manure on any naturally strong soil. There is, therefore, every reason to expect California to become a prominent cotton-producing State before many years.

In the coast region, north of San Diego, cotton fails absolutely. In the Los Angeles region cotton is not winter killed, and in San Diego, as well as Yuma, has fruited for three years in succession. A third year's staple grown at San Diego was rather short and harsh, seeming to confirm the experience of other countries as to the deterioration of the fiber after the first year. Yet it may be that the sample in question, as well as some others examined with a similar result, were from the neglected Mexican cotton, and that better varieties might be maintained in bearing, with good culture, for two years at least, thus saving the expense of planting for one year, and securing a very long bearing season during the second one.

The picking of cotton has thus far been done almost altogether by Chinese, who average about 75 pounds of seed cotton per day.

Excellent samples of cotton have been grown in Salt River Valley, Arizona.

Of other fiber plants, the ramie can be successfully grown almost throughout California, whenever the means of working this beautiful fiber shall have been sufficiently perfected. In the case of the ramie, as well as that of jute, the cost of labor will long stand in the way of profitable production, in competition with India and China, especially if Chinese labor should be excluded.

The hop plant is extensively cultivated in the middle portion of California, especially in the coast region north of San Francisco Bay, and the product is of very high quality. Here also the labor question is a critical point, all efforts to have the picking done otherwise than by Chinese having resulted unsatisfactorily thus far.

Beans, among them chiefly the Navy and Lima, are extensively grown in the coast counties south of San Francisco, and more or less all over the State, as a large scale crop.

SUGAR PRODUCTION IN CALIFORNIA.

The probabilities of profitable production of sugar were early considered in California, the more as several of the prominent sugar-producing plants were known to flourish in the different climatic regions of the State. Sugar cane was, and still is, a common crop on a small scale on the Mexican homesteads in the Los Angeles region, while beets, sorghum, and melons yield abundantly in the more northern portion. It was doubtless the scarcity of water, and the necessity for irrigation, that prevented earlier efforts to cultivate the tropical sugar cane in Southern California, and left the initiative of the sugar industry to the humble beet in Northern California, between 1874–'75.

BEET SUGAR.

Beet-sugar factories were established in Sacramento, Alvarado, Santa Clara County, and Soquel, Santa Cruz County; and each of these produced excellent samples of sugar for a time. But owing to a variety of causes, chief among which seems to have been a speculative rather than well-considered technical basis of operations, they proved financially unsuccessful. The Sacramento factory was in active operation only a short time. Its machinery was, in 1877, transferred to Isleton, on the Sacramento River, where it had one season's fairly successful run, but has since been at a standstill, apparently from want of proper technical skill in management, not certainly from want of the best material.

The Soquel factory has continued in more or less vigorous activity until within two years past, when operations ceased for reasons not apparent to the public. About the same time, however, the Alvárado factory, which had been in abeyance for some years, was revived under new management, and with improved machinery, and since then has continued in successful operation, as shown in the report of one of the members of this commission.

It is not the province of the writer to discuss all the alleged and possible external causes of these early failures, which in the public mind were connected more or less with the interests controlling the Hawaiian sugar trade. It suffices for our purposes to show that the natural conditions in a large part of California are eminently favorable to the production of beet sugar, and that one factory at least is entirely successful. The data given below will substantiate these points, as also the fact that a good quality of beets, at least, can be grown in Eastern Oregon and Washington Territory.

Sorghum has thus far been grown chiefly for forage or sirup-making. But during the last two years experiments in sugar-making from the Minnesota Early Amber have also yielded highly promising results. Some data regarding these will be found below.

The true tropical sugar cane succeeds admirably in the region of Los Angeles and San Diego, and has also had fair success in the southern part of the San Joaquin Valley. The need of irrigation and the uncertainties of the sugar market have conspired to prevent any large-scale of experiments in this direction.

The facility with which enormous quantities of watermelons of extreme sweetness can be grown in the middle portion of the San Joaquin Valley gave hopes that the production of sugar, or at least of sirup from that source, would be found profitable. A special investigation undertaken by the Agricultural Department of the University of California proved that unfortunately these hopes are not well founded.

The results of this investigation also are given below.

INVESTIGATIONS OF BEETS FROM CALIFORNIA AND WASHINGTON TERRITORY.

1. *Beets from Isleton, Sacramento County, California.*—Sent by Mr. F. A. Roe, October, 2, 1877. Raised from California seed (from Mr. Gwyn

Soquel) on low tule land, burnt two years ago. Average of the crop on 14 acres, about 15½ long tons; on some land, 23 tons.

Specific gravity of the juice (by spindle)		1.066
Amount of solid matter corresponding (if sugar)	per cent..	16.10
Amount of solid matter by direct determination	do....	17.51
Percentage of cane sugar in the juice	do....	14.69
Purity coefficient	do....	84.00

Dried beet fiber, 4.1 per cent. of the whole beet; ash of fiber, 2.97 per cent. of its weight, or about 0.12 per cent. of the weight of the whole.

Total ash in the juice	per cent..	0.58
Insoluble part of ash	do....	0.21
Soluble part of ash	do....	0.37

Alkalinity of soluble ash corresponds to 0.10 of sodium oxide, which, in evaporation, would render 1.10 per cent. of sugar uncrystallizable.

Constituents.	In 100 parts of solid ash.	In 100 of juice.
Oxide of potassium	43.25	.1606
Oxide of sodium	8.66	.0334
Chloride of potassium	12.81	.0494
Sulphuric acid	2.91	.0112
Phosphoric acid	9.73	.0374
Carbonic acid (by diffusion)	22.64	.0739
	100.00	.3700

These beets are of exceptionally fine quality for sugar-making. Other determinations of the quality of beets from the same locality have been made in succeeding years, as follows:

2. *Beets from Isleton.*—Received in December, 1878. It was desired to determine the relative value of beets planted at different times during the summer. Specimen No. 1 was planted in June, No. 2 in July, 1878. The determinations gave:

Constituents.	No. 1.	No. 2.
Specific gravity of juice, by spindle	1.0535	1.035
Solid contents corresponding, per cent	13.17	8.66
Total per cent. of ash in juice	1.55	1.10
Per cent. of soluble ash in juice	0.32	0.36
Alkalinity of soluble ash corresponding to SO_3, per cent	0.46	0.54
Amount of sugar that would be destroyed by the alkali in evaporation per cent	3.24	3.57

The absolute cane-sugar percentage could not be determined on account of the instrument being out of order. It is, however, easily seen that these beets were both considerably inferior in quality to those previously tested, especially so as regards the sample planted in July, which, being immature, was inferior to the earlier planted, not only in the percentage of sugar, but also in containing a larger amount of total as well as of soluble ash. Practically No. 2 would be unworkable under ordinary circumstances. As to the possible causes of the inferiority of the beets grown that year I have no information.

3. *Beet from Isleton.*—Grown in 1879; received in October; weight 12 ounces; crisp and in good condition.

Specific gravity of juice, at 17 per cent		1.06
Corresponding amount of solid matter in solution	per cent..	15.5
Per cent. of cane sugar by saccharometer	do....	14.0
Hence purity coefficient		90.03

This, again, is a very high-grade beet, with which any sugar-maker would be pleased. Assays of beets worked at Sacramento are reported to have often run as high as 19 per cent. of cane sugar; and considering that the Isleton beets were grown on fresh land by inexperienced growers, there can be no doubt that beets of unusually high quality may be grown in the Sacramento Valley, and doubtless also in that of the San Joaquin. To seaward of the Coast Range, the results obtained have not been so favorable, probably from the absence of a sufficiently high summer heat.

The table below shows the results of the examination of three lots of sugar beets sent, grown by Mr. D. F. Newsom, in the bottom of the Arroyo Grande, San Luis, Obispo County, in 1877. In some portions of this bottom a little alkali is apparent. It was stated that three crops could be readily grown in one season in the region. Average size of beets, about two pounds.

No. 1 was beets ninety days from the seed; No. 2, one hundred and twenty days. Both were taken up the last days of July. No. 3 was eighty days from the seed; taken up about the middle of September. The flesh of these samples was somewhat soft and flabby.

Composition of soluble part of beet juice, No. 1.

Constituents.	1.	2.	3.
Specific gravity of juice, by spindle	1.051	1.057	1.053
Solid matter corresponding	12.6	14.0	13.0
Cane sugar, by polarometer	8.44	10.0	9.85
Purity, coefficient	67.0	71.0	75 7
Per cent. of ash, total	1.36	1.14	1.17
Per cent. of ash, soluble	(*)	1.04	*

* Not determined.

Composition of soluble part of beet-juice ash, No. 2.

Constituents.	In 100 ash.	In 100 juice.
Potash	22.34	.232
Soda	14.59	.152
Phosphoric acid	6.25	.065
Sulphuric acid	3.50	.036
Chloride of potassium	36.52	.379
Carbonic acid and loss	16.80	.175
Total	100.00	1.039

A simple discussion of these results leads to the conclusion (which was verified by the alkalimetric method) that after clarification of the juice of No. 2 with lime, nearly a quarter of one per cent. of caustic soda will be present in the juice, which amount, according to the best experiments, would, in the evaporation, render eleven times that amount, or 2.75 per cent. of the sugar present, non-crystallizable, thus leaving only 7.25 as the best possible result of manufacture. This is economically out of the question.

The analysis of No. 3 seems to indicate that beets of the same age are richer in sugar when grown later in the season, probably on account of the higher temperature then prevailing on the coast. Nevertheless, both Nos. 2 and 3 are below the desirable average in respect to sugar percentage, and near the lower limit as regards the purity coefficient.

In both, the ash percentage, and the alkalinity of the ash, are so great as to render them an undesirable material for the sugar-maker. No. 1 is altogether below the admissible standard, in respect to sugar percentage, purity, and ash.

It seems necessary to conclude, therefore, that at present the Arroyo Grande bottom will not produce beets adapted to sugar manufacture, although it may do better after longer cultivation.

Beets from Guadalupe, Santa Barbara County.—Sent by Mr. James Morse. Having been three weeks on the way, they had sprouted leaves and fibrous roots into the soil, and were slightly wilted. The following is a summary of the results from the three specimens sent:

Constituents.	No. 1.	No. 2.	No. 3.
Specific gravity of juice (by spindle)	1.0412	1.065	1.0[illegible]
	per cent.	*per cent.*	*per cent.*
Amount of solid matter corresponding (if sugar)	10.2	15.8	7.[illegible]
Amount of solid matter by direct determination	10.68	17.06	....
Total ash percentage in juice	1.185	1.23	2.[illegible]
Insoluble ash in the juice	0.115	0.15	0.11
Soluble ash in the juice	1.07	1.08	2.[illegible]
Percentage of coagulable albumen in juice	0.834	....	....
Alkalinity of soluble ash neutralizes sulphuric acid (SO_3)	0.43	0.30	0.[illegible]
Per cent. of sugar destroyed in evaporation	3.60	2.50	4.[illegible]

These beets differ widely in their composition and value for sugar-making. No. 3 contains so little sugar—probably not over 6 per cent.—and so large an amount of soluble and very alkaline ash, as to put it entirely out of the question. No. 1 contains an adequate amount of sugar, but also more ash than is deemed admissible, especially as it is very alkaline; moreover, it contains a very large amount of albuminous matter. No. 2 is a very good beet, containing so much sugar—probably about 14 per cent.—that even its somewhat large ash percentage would not render it unacceptable, the ash not being very alkaline.

It would have been interesting to know just in what locations and under what circumstances these beets were grown, but I have been unable to obtain the data. As the record stands, it proves only that from the same seed very different qualities of beets may be grown, but these differences may be largely due to imperfect maturation, as in the beets No. 2, from Isleton, of 1878 (see above). In the widely different climates of California, it will be necessary to determine not only the proper soils, but more especially the proper times of planting for each location, before the best possible results can be obtained, the higher temperature then prevailing.

The following results were obtained in the assay of beets of the crop of 1879, grown by Mr. J. M. McElhany, of San Luis Obispo. These beets were somewhat shrunken, but otherwise in good order. One had the reddish color of a common beet, the other less red, and more like a regular sugar beet.

A portion of each was taken, and the two samples mixed for analysis.

Fresh beets from San Luis Obispo:

Specific gravity of juice	1.0[illegible]
Solid contents of juice	17.0
Percentage of cane sugar	13.0
Purity coefficient	76.5

These figures, it will be noted, agree very closely with those obtained from the beets grown by Mr. Nadeau, near Los Angeles, given below. It should not be forgotten that almost all have been grown on comparatively fresh soils, on which the best results of sugar-beet culture are rarely obtained.

SUN-DRYING OF THE SUGAR BEET.

That, in general, sugar beets of unusually high quality can be successfully grown in many regions of California, has now been sufficiently proved by the tests made up to this time, as well as by the practical working of the manufacturing establishments that have been managed with a reasonable degree of business tact and technical skill. That the profitable production of beet sugar depends on a great many conditions besides that of the quality of the raw material is too well known to need discussion. The beets will not bear transportation to any distance, and in order to render them available for sugar making their successful growing must, within a limited area, be coupled with cheap fuel, good and abundant water supply, and reasonably cheap and reliable labor.

It has often been attempted to free this industry from some of these restraints by rendering the beets transportable and capable of being kept all the year by drying. But to do this by artificial heat is so costly an operation that it can be made to pay only under peculiar circumstances; hence, as a matter of fact, this expedient has been thus far but little resorted to.

The dry summer climate of the interior of California, however, seems to offer unexceptionable facilities in this direction; for where raisins can be made successfully, cut beets can be dried without artificial heat. So far no raisin-making country has attempted the beet-sugar manufacture, hence the conditions offered here are entirely new.

At the suggestion of Mr. Ernest Th. Gennert, the well-known beet-sugar expert, who has been chiefly instrumental in introducing this industry east, experiments in the drying of beets in the open air were carried out in Southern California, and some of the beets so prepared were sent to the department for examination—one lot from near Santa Aña, Los Angeles County, by Mr. W. H. Spurgeon; the other by Mr. H. J. Rudisill, of Riverside, San Bernardino County. The following record of the progress of the drying process is given by Mr. Rudisill:

EXPERIMENT IN DRYING BEETS.

First experiment with "Mangold Wurtzel," from Santa Aña, Los Angeles County.

Date.	Temperature, Fahrenheit.			Weight of beets at 12 m.
	6 a. m.	12 m.	6 p. m.	
	°	°	°	*Pounds.*
September 29	....	76	68	100
September 30	58	82	73	46
October 1	60	85	75	20½
October 2	65	90	....	15

NOTE.—The first day the beets were spread upon a cloth on the ground, when I found they did not dry as rapidly as upon a scaffolding, or platform, a few feet above the ground, where the air can circulate freely.

Second experiment with "Sugar beets" from Northern California.

Date.	Temperature, Fahrenheit.			Weight of beets at 12 m.
	6 a. m.	12 m.	6 p. m.	
	°	°	°	*Pounds.*
October 16	....	79	73	100
October 17	55	85	78	29¾
October 18	55	85	....	25½

NOTE.—A light north wind set in on the morning of the second day, and continued during the experiment.

Of the drying at Santa Aña, done about the same time, Mr. Spurgeon reports that 100 pounds were in twenty-four hours reduced to 29½ pounds, they having been sliced crosswise into disks, about one-half an inch thick, and spread simply on boards. These slices when received here were dry, but pliable, and retained 20.6 per cent. of moisture, while those sent by Mr. Rudisill contained only 10.6, and would evidently have kept indefinitely, like well-dried apples. The results of their examination are given in the following table, the sugar percentage being stated both for the absolutely dry substance and for that containing 10 per cent. of moisture, as will be the case on an average in practice.

Varieties.	Sugar in sugar beets absolutely dry.	In beets dried with 10 per cent. moisture.			Ash in juice residue, per cent.
		Sugar, per cent.	Total organic matter, per cent.	Ash, per cent.	
Sugar beet, Riverside	68.0	63.0	86.09	3.91	5.411
Santa Aña (Mangold)	64.0	58.15	86.25	3.75	4.[illegible]
Santa Aña	62.1	55.92	....	....	5.218

Not having received any of the fresh material, I am unable to state precisely the original sugar percentage in the fresh beets; but a test made by Mr. Gennert gave somewhat over twelve per cent. Taking this as a basis, it will be seen that the weight of the raw material has been by drying reduced to one-fifth, thus, of course, diminishing the freight expenses in a corresponding ratio. It is obvious that a material containing from fifty-six to sixty-three per cent. pounds of sugar in the one hundred will bear shipment to any moderate distance, thus rendering it possible to locate the manufactory at whatever point may, on the governing considerations, appear most desirable.

During 1880 experiments in beet drying were carried out on a large scale in Los Angeles County, partly under the direction of Mr. Gennert, who hoped to be able to work the sun-dried roots by an abridged process that has proved feasible with fire-dried beets. The slicing machine followed the laborers digging the roots in the field, and for some time the expectations raised by last year's experience as to the facility of sun drying were realized. Foggy weather, unexpectedly setting in, retarded the operations, and as the sequel showed materially damaged a portion of the stock that was too hastily stored. Moreover, it was found that the sun-dried beets, not having been subjected to as high a temperature as in the case of fire drying, work like fresh beets, requiring the use of charcoal filters. Notwithstanding partial failures recorded from this year's experience, I am still of the opinion that it only requires a little more experience in the management of the drying process to render the dried-beet crop quite as certain and safe, as to quantity and quality, as any other now grown.

The failure of the apparatus successfully used for the manufacture of sugar from fire-dried beets, to accomplish the same object in the case of the sun-dried article, places the latter simply on a level with the fresh beet, so far as the purity coefficient is concerned; always provided that the drying process has been properly conducted under reasonably favorable atmospheric conditions. That this is really so is proved by the assays made of dried beets furnished by Mr. Gennert and Mr. R. Nadeau, of Los Angeles (the latter one of the parties most heavily interested in the enterprise), which are given below.

This assay is not as easy a matter as that of fresh roots, in which case the juice can be pressed and its quality ascertained in a very short time. In that of dried beets the substance has to be extracted with water; and according to the quantity and temperature of the latter, the results, especially as to the purity coefficient, may vary materially, the latter being usually depressed.

After a number of experiments, the following general method was determined upon and adhered to. Thirty grammes of dried beets were finely "hashed," and then allowed to soak over night in an amount of water sufficient to swell them to their natural bulk, and cover them over. In the morning the swelled beets were placed in a displacement apparatus, and water kept to 50° centigrade was allowed to pass through slowly, so as to amount to six hundred cubic centimeters, more or less, by three o'clock in the afternoon, by which time the extract had ceased to show any sugar in the polarizer. The residue was then pressed for the last portions of the juice, and the extract immediately treated in accordance with the usual methods pursued in the case of fresh juice.

The results given in the table, with the exceptions noted, were obtained according to this process. In judging of the variations, it must also be kept in mind that the amount of moisture contained in the sample, at the time the test was made, was not in every case determined. The average commercially assumed is about 10 per cent., but in small samples exposed to the air it may vary from about seven to twelve and more. This, of course, produces an apparent variation in the sugar percentage, which, however, is unimportant for the present purpose.

No. 1.—Sliced and dried beets received from E. Th. Gennert, Los Angeles, September 20, 1880. Grayish-white, uniformly brittle. Under the microscope show on the surface abundant brownish crystals of cane sugar. Taste, that of fresh beets; color of the extract same as fresh juice.

No. 2.—Sliced and dried beets received from the hand of R. Nadeau, of Los Angeles, October 5. Aspect, color, &c., about the same as in No. 1; color of extract the same; sugar crystals on surface not quite so abundant.

No. 3.—Two fresh beets, sent from Alvarado sugar factory, said to come from R. Nadeau, Los Angeles, and presumed to represent the quality of the beets dried by him. Slightly wilted when received, October 31, but otherwise in good condition. Each was separately assayed.

Sample.	Specific gravity of juice or extract.	Solid contents of juice or extract.	Percentage of cane sugar.	Purity coefficient.
No. 1. Dried beets, from E. Th. Gennert:				
A			51.33	
B			50.00	
C	1.0105	2.69	56.34	79.92
No. 2. Dried beets, from R. Nadeau:				
A			42.07	
B	1.0100	2.56	46.05	68.40
C	1.0108	2.77	46.87	69.9
No. 3. Fresh beets, from R. Nadeau:				
A	1.070	17.14	12.8	74.9
B	1.071	17.14	12.3	71.5

Determinations A and B, No. 1, were made before the regular process above detailed had been adopted, and are affected by incomplete extraction as well as by a high percentage of moisture. The same is true of A, No. 2. The last determination in each case I consider the true standard of comparison, the others being simply corroborative and minimal. It will be seen that in the case of Nadeau's beets the fresh and dried beets accord in regard to purity coefficient quite as nearly as is commonly the case with different samples of fresh beets. *If there has been any lowering of this important factor by the drying process, it has been insignificant.* Moreover, the percentage of sugar in the dried sample is almost precisely what it should be, in the accepted proportion of four parts by weight of green beets to one of dried.

The conclusion is, that green beets of proper grade for sugar making do not loose their usefulness for this purpose, in any sensible degree, by a *carefully conducted* process of sun drying in the climate of Los Angeles. This is abundantly corroborated by the results obtained from the sample furnished by Mr. Gennert, evidently made from a beet of higher sugar percentage than the average (which seems to be about 12 per cent.), and also of high purity coefficient. No sugar maker could desire a finer material to work upon.

In the face of these facts, which only confirm the reasonable supposition of any one familiar with the subject, and with the climatic conditions of Southern California, the statement, somewhat industriously circulated, that the whole scheme is a failure, appears rather premature. There certainly has been a failure of success in treating the sun-dried beets like those dried at a higher temperature, and it is greatly to be regretted that this important point was not ascertained before heavy investments in beet drying were made. In addition, there has been a partial failure to manage the drying process so as to secure a uniformly good product, and this, as might be expected, has carried with it a failure to produce from the resulting material such average of sugar as might have been justly expected from the quality of the green beets, as well as from the assays above reported.

My attention was drawn to this fact by a communication from Mr. E. H. Dyer, superintendent of the Alvarado sugar factory. He stated that the sugar obtained from the working of five tons of Mr. Nadeau's dried beets had yielded only 20 per cent. of manufactured sugar, and sent at the same time a sample of dried beets, stated to be similar in quality to the lot used in the experimental manufacture.

This sample of dried beets differed very obviously in appearance from those furnished by Mr. Gennert and Mr. Nadeau. Its aspect was darker, and inspection, as well as microscopic examination, showed it to consist largely—to the extent of about one-half by bulk—of brown, soft shreds, with but few sugar crystals on the surface. Some of these showed o the cross-cut a white center streak within the brown covering. Th lack of sweetness and the difference of taste was noticeable at once. Th different portions of the sample, moreover, differed in the proportion o the sound, white fragments intermixed with the brown.

The following assays have been made at the California Agricultura College of beets received from parties in Washington Territory, desirin authentic information as to the quality of the beets thus far produce by them on a small scale:

No. 1.—Beets grown by Mr. S. M. Wait, of Dayton, Washington Ter ritory; one weighing about 17 and the other about 12 ounces; crisp an in good condition when received.

No. 2.—Sugar beet grown by Mr. E. Meeker, Puyallup, Washington, Territory; sent at the request of Mr. M. G. Marsiliot, of the United States revenue steamer Wolcott, Port Townsend; weight about 16½ ounces; somewhat bruised and wilted when received.

Constituents.	No. 1.	No. 2.
Specific gravity of juice	1. 065	1. 058
Percentage of cane sugar	12. 38	12. 68
Purity coefficient	78. 3	90. 5

This is a very fair showing for the Washington beets, but it is probably not the best that can be done. No. 1 was decidedly immature as yet, as was shown by the peculiar behavior of the juice. A few weeks' more growth would doubtless have greatly raised its purity coefficient and also its sugar percentage.

The high purity of the juice of No. 2 is very encouraging, and if similar in the roots grown in Eastern Oregon and Washington, the sun-drying process would probably be found as applicable there as in Southern California. The frequent summer rains of the Puyallup region would forbid the use of this method there.

So far as known, no attempt to cultivate the sugar beet has as yet been made in Arizona, or in the interior Territories.

The following table shows the results of assays of this sample, the first two being taken from different portions of the mass, the third representing the average of the whole:

Constituents.	Dried beets from Alvarado.		
	A.	B.	C.
Specific gravity of juice or extract	....	10. 13	1. 0065
Solid contents of juice or extract	....	3. 09	....
Percentage of cane sugar	23. 29	34. 15	26. 24
Purity coefficient	....	51. 46	47. 00
Moisture, per cent	....	11. 50	....

A comparison of these results with those recorded on the previous table shows an enormous difference, not only in the sugar percentage (nearly two to one), but also a depression of the coefficient of purity, which renders the material altogether unfit for the purposes of the sugar-maker. In the interest of a promising industry it cannot but be a matter of regret that the only large scale attempt to manufacture sugar from sun-dried beets should have been made with half spoiled stock, which, by a little attention and technical understanding, could have been readily recognized as such and rejected. While it proves nothing at all against the feasibility of such manufacture, it has engendered a prejudice in the public mind which it may take some time to overcome. It is not unusual that such mistakes are made in the infancy of a new industry or improvement, or that manufacturers and others, having their regular routine and established interests, should assume a negative attitude toward it. It may even, for a time, be dropped altogether; but if intrinsically sound, as I fully believe the beet-drying industry will prove to be, it will, in time, find its place among the recognized branches of California agriculture.

It would thus seem that in California, if anywhere, the beet-sugar industry may look forward to a prosperous future; the only possible danger being the open competition of the sugar cane, both at home and abroad, with which, having the advantage of a purer juice, obtained with little trouble and expense, and yielding a merchantable sirup as its by-product, it would seem impossible for the beet to compete. It has done so elsewhere, mainly under the protection of a tariff, or (as between the East and the Sandwich Islands), under that of long transportation. While this is true, it is also indisputable that, both in California and in the East, the beet-sugar manufacture has proved remunerative whenever conducted under proper management and good natural conditions; and when the drying process is brought in, enabling the manufacturer to run throughout the year, as against the sugar-cane process, which is crowded into a short harvest season almost everywhere (save in the Hawaiian Islands), enabling him also to boil juices even more concentrated than that of the sugar-cane, by the use of the maceration process. The balance of advantage may readily, after all, be found on the side of beet-sugar industry. It seems probable at this time that this question will soon be practically tested, perhaps not only in California, but also further north, the high prices of sugar and their frequent and apparently arbitrary fluctuations having called popular attention strongly to the subject.

REPORT ON THE STANDARD SUGAR REFINERY, ALVARADO, CALIFORNIA.

By R. W. Furnas.

The commission, under special instruction to "particularly investigate and report the present status, operations, capabilities, actual productions, and future prospects of the 'Standard Sugar Manufacturing Company,' at Alvarado, Cal.—the operations of this company embracing its means and efforts in raising beets, as well as the results of its manufacture of sugar"—report a visit to the manufactory on October 18, 1881, and found it in charge of Mr. E. H. Dyer, general superintendent, who cheerfully afforded every means for obtaining desired information.

The system in use is known as the "Roberts Diffusion." Operations were first commenced in the year 1870. Over a quarter of a million dollars were sunk or lost before any profits were realized. The original investment was a fraction over $200,000. The present (second hand), $135,000. The working season is from September to February. During that time, 1,239,503 pounds of sugar were made in 1880-'81, as shown by the books of the company. The quality of the product ranks high, and, where it is not known as beet sugar grades with Cuba brands. Sold under its true name, however, it commands a small fraction less, say one-eighth to one-fourth of a cent per pound. Eighty hands are employed in the factory proper. Skilled labor is paid $3 to $3.50 per day; the "boiler" $6 per day. Unskilled labor the same as in other industries in the locality. Common laborers, principally Chinese. "In fact," says the superintendent, "we cannot get along without Chinese labor."

Experience shows that 16 per cent. saccharine matter in the beet juice will yield 13 per cent. of sugar; 20 per cent. of saccharine matter, 18.9 sugar. The last is considered an extra quality and yield.

The capacity of this factory is 100 tons of raw beets per day; 12,000 tons are worked up during the season. About twenty-four hours are consumed from the time the raw beets enter the washing-machine until the perfect sugar is produced. The company principally contracts with farmers for beets delivered, paying from $4 to $4.50 per ton, as they come from the field, topped. The average yield is 15 tons per acre. Medium-sized beets are preferable in all respects. The most profitable and desirable variety of beet is the White Silesian. The company has 100 acres of its own in beets. Land in this vicinity, suitable for beet culture, is valued as high as $300 per acre. Land rents for $20 per acre.

The commission, before visiting, was advised that there existed in the public mind a strong suspicion that, even in the management of the Alvarado Factory, there were interests adverse to successful sugar-beet manufacture in the United States, and hence failure was preferable to success. After careful investigation, the commission do not share in such suspicion, as regards this establishment at least, but are of opinion that good faith has been exercised, and everything possible done to render the enterprise a success; and this, we further believe, has been accomplished. Mr. Dyer has been connected with the effort from the first, is still a party in interest, and quite elated over the final result in securing a prime article of sugar, with fair marginal profit.

That the sugar-beet industry in the United States is now an established fact, your commission entertain no doubt, and think that the importance of encouraging it cannot be overestimated.

The wise policy of France, Germany, and other foreign countries, with natural advantages not superior to ours, has made them exporters of beet sugar.

Without attempting argument on this point, we are free to advise, at least, such aid, both national and State, as will remove any and all obstacles that may stand in the way of successful prosecution of individual efforts now being made or hereafter to be made. We learn a leading existing obstacle to be the inability to utilize all the products of sugar beets—what is known in business parlance as "low products." After investigation, thought, and conviction as to the particular point involved, we cannot more plainly state the case than to use the words of Superintendent Dyer in presenting the matter:

> In the manufacture of beet-root sugar, we have a large quantity of molasses that is unfit for domestic use, and can only be utilized profitably by distilling into alcohol. This is done in Europe, and is a source of income.
>
> This alcohol cannot be converted into whisky, as it has an unpleasant taste and odor, and can only be made useful in the arts or for mechanical uses. But in consequence of the heavy internal-revenue tax, distillers here claim that they cannot afford to pay us but about the cost of cooperage and freight, and we are obliged to run the beet molasses to waste.
>
> In consequence of this we lose an important source of income. In Europe, after the molasses is distilled, the salts remaining are all profitably utilized in the manufacture of different chemicals. We are deprived by this tax of all these sources of income. We ask Congress to grant us relief from this loss, by permitting alcohol to be distilled from beet-root molasses and be exempt from paying an internal-revenue tax.
>
> Proper safeguards can be devised to prevent fraud. No molasses should be allowed to be distilled until after at least three products of sugar have been extracted. There still remains a large percentage of sugar that is uncrystallizable on account of the salts and other impurities which always remain in the molasses.

In conclusion, the commission join in a desire that Congress aid this great enterprise in such manner and to such an extent as in its wisdom will best secure the interests of the American people, believing that in so doing an industry will be developed second to no other in the United States.

SUGAR CANE AND SORGHUM.

By E. W. HILGARD.

The culture of sugar cane has not, as yet, been carried on on a large scale in California. But numerous experiments on a small scale have shown that it succeeds well and is of good quality in Los Angeles, San Bernardino, and San Diego Counties. Whenever grown on irrigated ground there can be little doubt that it will also succeed in a large part of the San Joaquin Valley, as, according to Mr. W. H. Sanders's experience, it does in Fresno.

The extension of its cultivation will, I think, depend more upon commercial than climatic considerations; although probably the "bay climate," as well as that of the immediate coast southward, is probably too cool to develop the saccharine juice to perfection.

Not so with the sorghum, which succeeds well from San Diego to Oregon, though probably with great variations as to its sugar percentage. Several varieties of sorghum have for some years past been grown on the experimental grounds of the Agricultural College at Berkeley, and the results of the assays of some of the samples so grown are given below. In the great valley of California, sorghum has long been grown for forage, to a greater or less extent; but the introduction of varieties specially adapted to sugar making is of comparatively recent date. Assays of Early Amber cane, grown from seed received from the Department of Agriculture at Washington, at Bakersfield, Kern County, and on the Lower Sacramento, are given in the table below. Excellent samples of raw sugar, rudely made from sorghum juice, have also been received from Bakersfield. The samples grown on the Sacramento were intended to be worked into sugar at the Isleton beet-sugar factory, but the result has not transpired.

It is apparent at a glance that the showing for sugar-making purposes is considerably better than the average shown by the experiments made at the Massachusetts Agricultural College, and quite as encouraging as the results obtained in the Western States during the past seasons.

Doubtless the climate and soil have a great influence on the absolute and relative amounts of the several kinds of sugar, and actual experiment can alone determine whether or not in any particular region the quality of the juice can be made such as to render sugar making profitable. The fact that the Amber cane juice was of such good quality even in the bay climate, would seem to render it probable that in the warmer climates in the interior much better results could be obtained, as is actually shown by the assay of the Bakersfield samples.

An assay of sugar cane grown and cut late in December serves for convenient comparison both as to sugar percentage and purity.

No. 1.—Amber cane grown on the agricultural grounds of the University of California; cut during the first week in October, 1879, grain being in dough. In 1880 the cold, foggy summer was a drawback to the development of the saccharine juices, and the results have probably been as little favorable as they are ever likely to be.

Samples of sorghum, grown during that season, were received from Bakersfield, Kern County, from Mr. J. W. Brooks, secretary of the Kern County Improvement Association, under whose auspices seed was distributed last spring.

No. 2.—Early Amber, from Bakersfield, was considerably wilted when worked. Received October 5, 1880.

Nos. 3 and 4.—The Imphee and Minnesota Amber canes from Bakersfield were rather wilted, but not so dry as No. 1. Received November 15, 1880.

No. 5.—The Amber from University grounds was worked the same day it was cut, November 16, 1880.

No. 6.—Cuzco corn, grown by Mr. Chabot, of Fruit Vale, near Oakland. Fresh and very succulent. Received in October, 1880.

No. 7.—Grown and sent by Charles A. Wetmore. Received and assayed January 6, 1881.

No. 8.—Grown on Sacramento River, six miles above Rio Vista. Forty-two days' growth; cut on August 5; received and assayed August 12, 1881. It was somewhat dry, as it had been exposed to the air after being cut. Sent by Maximilian Taubles.

No. 9.—Grown at Isleton; planted May 15, 1881; cut August 22; average height of stalk 9 feet 6 inches, and thickness 1 inch. Assayed August 24 (sample from four stalks). Sent by Mr. Taubles.

Assays of California sorghums and sugar cane.

Varieties.	Specific gravity of juice.	Solid contents of juice.	Percentage of cane sugar.	Purity coefficient.
1879.				
No. 1. Early Amber, University grounds	1.0605	14.8	10.1	68.2
1880.				
No. 2. Early Amber, from Bakersfield	1.082	19.87	15.15	76.75
No. 3. Imphee, from Bakersfield	1.095	22.60	9.30	58.80
No. 4. Dark Early Minnesota Amber, from Bakersfield	1.100	24.60	14.03	58.02
No. 5. Early Amber, University grounds	1.076	18.55	13.67	76.39
No. 6. Cuzco cornstalk, Oakland	1.050	12.61	7.05	64.00
1881.				
No. 7. Early Amber, Sacramento County, immature	1.072	17.59	4.32	24.56
No. 8. Early Amber, Sacramento County, mature	1.067	16.41	10.87	66.24
No. 9. Sugar cane	1.076	18.4	16.09	92.09

It appears from the above table that the Early Amber cane, even in the past unfavorable season of 1880, has, in Kern County, attained a sugar percentage almost equal to the average of Louisiana sugar cane, with a very satisfactory purity coefficient, between seventy-six and seventy-seven; and even in the cool bay climate, and under the summer fogs of the Golden Gate, it has reached 13⅔ per cent., with an equally good purity coefficient.

The "Dark Early Minnesota Amber" has rather too low a purity coefficient for sugar making, at least at the time when tested. It seemed a little past the best condition.

The Imphee is very far inferior to the Early Amber, and, as the sample stood, would not even have made very good sirup.

The stalk of the Cuzco corn, though having a somewhat higher purity coefficient than the Imphee and Dark Amber, would also serve for sirup only; and considering its low percentage in the juice, and smaller production on the same area, there can be no reason to prefer it to the Amber cane. The latter seems, therefore, decidely *the* crop to select for sugar, making, unless, indeed, the true sugar cane should yield a much better result than there is reason to anticipate, considering experience in the Southern United States. The rapid growth and early maturity of the Early Amber alone recommend it highly, as against the tardy maturity, and frequent damage from frost that proverbially render the culture of the true sugar cane in Louisiana a matter of thirteen month's work, and very liable to accident.

The continued interest in the subject of sugar production at home, as well as the desire for a greater diversification of crops, has induced numerous experiments in the growing of sugar-producing plants during the past few seasons. This has especially been the case in the Upper San Joaquin Valley, Kern, Tulare, and Fresno Counties.

SUGAR FROM WATERMELONS.

The practicability of manufacturing sugar from melons has often been discussed, and varying opinions on the subject have been put forth, based, doubtless, upon the varying results obtained in different climates and soils. Both watermelons and muskmelons have been actually used for the manufacture of sugar in Western Europe; but the fact that the industry has never assumed important proportions seems to indicate that it is subject to special difficulties. On the whole, it is well understood that the sugar contained in fruits is predominantly of the non-crystallizable kinds, viz., grape and sirup sugars rather than cane sugar; yet the latter is very generally present, and in varying proportions, according to circumstances, even in the same fruit.

The facility with which watermelons especially may be grown in the warmer portions of the State, their fine quality and great abundance, so as to be frequently a drug in the market, forcibly suggests that, if it be possible to use them in the manufacture of sugar or sirup, it might be a profitable industry, since it could be carried on on a small scale by farmers, with very little outlay for appliances, for the juice of the watermelon is easily obtained, and is so nearly free from the impurities which render the working of beet juice troublesome and expensive, that little, if any, purification (defecation) would be likely to be needed before evaporation.

Upon a suggestion made in August of the present year, through the columns of the *Rural Press*, by Mr. H. Hutchins, of Lodi, San Joaquin County, a full investigation of the subject was determined upon, and the material therefor was furnished by Mr. Hutchins, in the shape of a crate of fine melons, about the middle of September. The melons were of two varieties—one long, with thin rind and yellow seeds, red-fleshed and very sweet; the other, roundish and short, with thicker rind and firmer pulp, not quite so sweet to the taste.

Seven melons altogether were examined, a record being kept of their respective weights, form, degree of ripeness, &c., and in Nos. 1 and 2, considered as representative samples, respectively, of the long and round varieties, the proportion of the rind to pulp and kernels was determined.

Melon No. 1.—Long, thin rind, white seed, fully ripe.
Melon No. 2.—Short, roundish, thick rind, moderately ripe, black seed.
Melon No. 3.—Like No. 1, black seed, slightly over-ripe.
Melon No. 4.—Like No. 2, smaller, very ripe.
Melon No. 5.—Like No. 3, but quite under-ripe.
Melon No. 6.—Like No. 2, but fully ripe.
Melon No. 7.—Like No. 1, smaller, rather green.

Table of results of examination of watermelons.

I.—JUICE.

	Weight of melons.	Specific gravity.	Solid matter.	Cane sugar.	Other sugar and impurities.	Total ash.
	Kil.		*Per cent.*	*Per cent.*	*Per cent.*	
No. 1	[*]13.0	1.039	9.75	2.71	7.94	.27; .09 soluble; .18 insoluble.
No. 2	11.75	1.035	8.8	[†].823	[†]7.977	
No. 3	5.30	1.0388	9.75	[†]1.97	[†]7.78	
No. 4	7.50	1.0387	8.7	[†]1.4	[†]7.3	
No. 5	7.50	1.036	9.0	2.07	6.93	
No. 6	11.20	1.0345	8.625	2.42	6.205	
No. 7	10.60	1.038	9.5	3.46	6.04	

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[*] The kilogram is nearly 2¼ pounds.

[†] It is probable that the cane-sugar determination in these cases was too low, in consequence of an error in manipulation, and should be thrown out in averaging the results.

II.—WHOLE MELON.

	Per cent
No. 1, consisting of—	
Seeds	1.20
Pulp	48.796
Rind	50.000
No. 2, consisting of—	
Seeds	1.35
Pulp	35.68
Rind	62.97

III.—MELON PULP AFTER PRESSING JUICE.

No. 1.—	Ash	.345
	Organic matter	6.891
	Water	92.764
No. 2.—	Ash	.275
	Organic matter	4.43
	Water	95.294

IV.—JUICE OF MELON RIND.

		Per cent.
No. 1.—	Specific gravity	1.022
	Solid matter	5.7
	Cane sugar	.328
	Other sugar and impurities	5.371

V.—PRESSED PULP OF RIND.

		Per cent.
No. 1.—	Ash	1.169
	Organic matter	6.708
	Water	92.123

VI.—SEEDS, FRESH.

		Per cent.
No. 1.—	Ash	1.54
	Organic matter	48.66
	Water	49.8
No. 2.—	Ash	1.278
	Organic matter	41.8
	Water	56.922

VII.—NO. 2.—SEEDS, AIR DRIED.

	Per cent.
Husks	66.042
Kernels	37.958

VIII.—KERNEL HUSKS, AIR DRIED.

	Per cent.
Ash	1.442
Organic matter and water	98.958

The hulled kernels, by drying and extraction with boiling ether, were found to be of the following composition:

IX.

	Per cent.
Water	11.212
Oil	43.15
Extracted kernels	45.638

On burning the extracted kernels, they yielded 9.61 per cent. of ash, and therefore contained 90.39 per cent. of vegetable matter.

From the data given in tables seven and nine, it appears that the air-dried melon-seeds contained 15.4 per cent. of oil. This oil is pressed in the south of France and used for the table.

As to the main point in question, it appears from table 1 that the average amount of all kinds of sugar and solid matter in watermelon juice is a little over nine (9.1) per cent. on an average, but that of this amount only 2.66, or not quite one-third by weight, is cane sugar. This is far too little, in proportion to the other substances, to be made available for the manufacture of cane sugar, and the proposition to use the watermelon for this purpose is thus effectually disposed of in the negative.

Nevertheless, it appeared probable that a bright and palatable sirup, not liable to granulation, could be advantageously produced from the watermelon, especially since the amount of ash in this juice is so insignificant; but on making the experiment it was found that whether the juice be evaporated by itself, and purified only by skimming, or whether it be defecated with lime, as seems most desirable, the resulting sirup was always of so very dark a tint, although pleasant to the taste, and therefore well enough adapted to home use, it would scarcely be accepted in the general market. I hope yet to devise means practicable in the family for obviating this unexpected difficulty. It is, of course, readily overcome by filtration through bone charcoal, as is done in sugar refining, but this operation is too troublesome, lengthy, and costly on the small scale to be resorted to by housekeepers in the country.

The darkening of the sirup is obviously due to the influence of the air on some organic substance (oxidation), and not to any action of the ash ingredients, whose amount is scarcely one-half of what is found in the best beet juice.

GRAPE SIRUP.

It has already been stated that during the period of greatest depression of the wine interest in California, other modes of utilizing the grape were sought for by the grape-growers, and among these was the conversion of the fresh juice into sirup. A large-scale experiment in this direction was made in 1876 by Mr. Weinberger, of Saint Helena, Napa County. The must was clarified with lime, and then evaporated. While it is not likely that the temptation to thus dispose of the grape crop will occur again, the results obtained should be put on record.

The specimen was furnished for examination as to the possibility of preventing the separation of the grape sugar, whereby the whole becomes solid, or at least a thick paste. In this condition it is not considered a very merchantable article. When received the sample had but a slight sediment of grape sugar, but after some weeks the whole appeared solid. The color was light brown, taste pleasant, but without any distinct grape flavor. The sirup dissolved in water perfectly clear, and addition of alcohol gave no precipitate either of gum or albuminoids.

Specific gravity	1.385
Water remaining, per cent	20.80
Amount of ash, per cent	1.014

This ash consisted mostly of phosphates of potash and soda, the rest being phosphates of lime and magnesia.

The sirup is slightly acid, to an extent corresponding to the presence of 0.56 per cent. of tartaric acid. The sample being small, the nature of the acid was not determined. It would be interesting to know whether it was a remnant of the natural acidity of the grape, or formed in the evaporation after the clarification.

As regards the means of preventing the solidification of the grape sugar, it should be kept in mind that, in the usual mode of preparing grape sugar from must, it is prescribed to "neutralize" the acid of the juice with lime in order to prevent its action on the grape sugar, by which the latter is gradually (or in boiling more rapidly) transformed into "sirup sugar." The more acid the juice can be allowed to remain, consistently with proper clarification, the less liable will it be to solidify afterward. The color of sirup made from *acid* juice will, as a rule, be darker, but its taste and flavor will nevertheless be more agreeable than when boiled from juice completely neutralized by lime.

It is, however, scarcely to be supposed that the objection of the consumers to the pasty condition of well-flavored grape sirup will be permanent when the quality of the article is once well understood, and a taste for it established; both consistence and color are likely to be disregarded in this, as they are in so many other articles of diet.

HORTICULTURE AND VITICULTURE.

By R. [illegible]

LEGISLATION REGARDING HORTICULTURAL INTERESTS.

The importance of general fruit-growing in California is being fully appreciated by the people, and they are acting accordingly. The State has been liberal in provisions and appropriations by legislative enactment. The industry is divided into two classes or departments, designated as viticulture and horticulture. For each the State is districted, with commissioners for each district, which together constitute a State board.

The viticultural districts are seven in number; one commissioner for each, and four commissioners for the State at large, all appointed by the governor.

Each county constitutes a horticultural district, with three members of the board, appointed by the county supervisors, on petition of five resident fruit-growers. The powers conferred are ample to render labors practical and efficient, being substantially those of a board of health.

The viticultural districts are:

Sonoma district.—Including Sonoma, Marin, Lake, Mendocino, Humboldt, Del Norte, Trinity, and Siskiyou counties.

Napa district.—Including Napa, Solano, and Contra Costa counties.

San Francisco district.—Including the city and county of San Francisco, and the counties of San Mateo, Alameda, Santa Clara, Santa Cruz, San Benito, and Monterey.

Los Angeles district.—Including Los Angeles, Ventura, Santa Barbara, San Luis Obispo, San Bernardino, and San Diego counties.

Sacramento district.—Including Sacramento, Yolo, Sutter, Colusa, Butte, Tehama, and Shasta counties.

San Joaquin district.—Including San Joaquin, Stanislaus, Merced, Fresno, Tulare, and Kern counties.

El Dorado district.—Including El Dorado, Amador, Calaveras, Tuolumne, Mariposa, Placer, Nevada, Yuba, Sierra, Plumas, Lassen, Modoc, Alpine, Mono, and Inyo counties.

County boards of horticultural commissions, at date of this report, exist in Sacramento, Yolo, Solano, Santa Barbara, El Dorado, San Bernardino, Santa Clara, Santa Cruz, San Joaquin, Amador, Alameda, Contra Costa, Nevada, and Placer.

GENERAL REMARKS ON VITICULTURE AND FRUIT-GROWING IN CALIFORNIA.

The history and results of grape-growing and wine-making in California is interesting, and, in addition, singular. Of course for years those engaged in attempts to manufacture wines fitted for market were the merest novices. When experts even came into control of manipulations, there were still objections to California wine. It was too this, too that, and the other. Soon, however, there was a foreign demand for it. After a round trip across the ocean, it was found, even in California markets, disguised under foreign labels, and pronounced by connoisseurs all the most fastidious palate could demand. There are many "old settlers," even in California, who still adhere to the fashion of calling for "French wines" in preference to their own. The writer was an eye-witness to instances where experts, with such preferences, were called upon to decide, when labels were "mixed." In each instance award was made to the California product, although the predjudice of the individual deciding was the contrary. It is now an established fact, in the opinion of the commission, that as good wines *can* be produced in California as elsewhere. If California fails to obtain the credit which in reality is due her, she alone is to blame.

While producers were dependent on green-fruit markets, fruit culture was soon overdone. Many who engaged in it early abandoned the enterprise for this reason. Now the improved modes of drying, "desiccating," and of canning fruits, and wine and brandy making, being in successful operation in almost all parts of the State, and good prices paid, a new impetus is given to fruit raising and the fruit trade.

After full and careful examination of this industry, I am convinced that the conditions for successful fruit culture in California are unexcelled. The climate and soil combined are specially adapted to the culture of wine and raisin grapes, pears, peaches, plums, apricots, and prunes. Not as much is claimed for apples as for the fruits above named. And yet, at several points, as fine apples were seen, both on trees and on exhibition, as before noted anywhere. Quality was often questioned, and but few claimed keeping character equal to those from Oregon, or the more northern regions of the State itself.

In the appropriate place in this report I present statistical facts relating to fruit products. Orchards were visited in person in various representative districts in the State; also, some of the most extensive canning, packing, and desiccating establishments, and wine and brandy manufactories in the northern, middle, and southern regions.

A peculiar characteristic of California fruit trees is that they bear younger and are more prolific than elsewhere. Often two or three year old trees in nursery rows are full to breaking down. When in full bearing they are more regular bearers; that is, bear well, as a rule, successive years.

There are wonderfully diversified producing and climatic characteristics found in California. The extent of territory from north to south gives climates almost from one extreme to the other, with extensive intermediate, or medium, areas. A line drawn through the center of the State, following the curve of its western boundary, north and south, will measure nearly 800 miles, the average breadth being, say, 250 miles. The surface consists of mountains, valleys, and plains. Two great mountain ranges traverse the State north and south—the Sierra Nevada on the east and the Coast Range on the west, with intermediate ranges less pretentious. Almost any climate desired can be had, from perpetual snow-clad and ice-locked peaks to scorching Sahara. In the southern half of the State nearly all semi-tropical fruits are grown successfully. In fact, I saw fine oranges growing in Marysville, north of Sacramento, and was told they are found still further to the north.

While it is not contemplated giving full and detailed statistics of the State, or even localities, relative to different factors of the fruit industry, a few representative results are given, merely to show what has been and can be done.

The vine was among the culture plants earliest introduced into California by the Catholic missionaries. It was found growing around the old missions by the early American emigrants, and hence received the name of "Mission" vine, which it still retains. It is a rapid grower and very productive; the grape is very juicy, rather small, light colored, bluish black, round, in straggling bunches, very sweet, with very little acid, and no definite flavor. It therefore produces a fiery, light-colored wine, of little body and no appreciable bouquet, deficient both in acid and tannin.

In the beginning of grape culture in California, it was exclusively planted, and the indifferent wines made from it alone, and brought into market in an immature condition, created the impression that no better wines could be produced in California, a prejudice which has but lately been definitely abandoned, in consequence of the appearance on the market of large quantities of excellent wines made from other varieties of the European grape, of which at this time there are but few prominent ones unrepresented in California.

Until quite recently, grape varieties derived from the American stocks were represented in California only as experiments or curiosities. The appearance of the phylloxera first called serious attention to the American varieties as resistant stocks for grafting the desired European grapes; but of the large quantities of cuttings introduced in consequence of this demand, a considerable proportion will also be grown for their own fruit, and will thus afford opportunities for combinations and blends never before tried on a large scale. At the same time the coming and employment of more professionally qualified wine experts will materially aid in correcting the errors heretofore committed, and in producing the best results attainable from the great variety of materials at command.

The cultivation of the European grape varieties has been altogether unsuccessful in the United States outside of California, Southern Oregon, part of Arizona, and New Mexico, and perhaps a part of Southern Texas. Hence wines similar to those now commanding the world's attention can be produced only in these regions, rendering it probable that there the American varieties will always be regarded more as auxiliaries for blending than as prime factors in the production of wines. In addition to this, the adaptation of the climates of Middle and Southern California and Arizona to the manufacture of raisins, so far made only from the European grape varieties, renders a continued preference for these still more certain. Even the appearance of the phylloxera is not likely to interfere in any material degree with this programme, since the pestiferous insect evidently labors here under special disabilities, which render its presence much less formidable—and its inroads comparatively easier of control—than is the case either in the Mississippi Valley or Europe.

The period of greatest depression of the grape-growing industry was reached in 1875–'77, when the prices of grapes were so low, and the stocks of wines on hand unsold so great, that in some cases hogs, calves and turkeys were turned into the vineyards to harvest the crop, and other modes of utilizing the fruit were sought, such as the making of sirup from the clarified juice, as detailed in another place. From this depression there has been a remarkable and almost bounding revival of prosperity, the first occasion of which was the alarm excited in France by the inroads of the phylloxera, and the search after some source from which the deficient vintages could be complemented so as to retain the world's trade in its own channels. Since then, the progress made has been rapid beyond all expectation, so that at this time—1881-'82—the demand for cuttings for the planting of new vineyards has outstripped the supply, and the additional acres that will have been put in in one season will be counted by many thousands. From this revival of prosperity there is every reason to believe there will be no falling back, unless it be by the most grievous fault of the wine producers themselves. As the depression was, beyond doubt, attributable chiefly to the hasty putting upon the market of immature and indifferently made wines, so the return of prosperity has been, in a great measure, the result of steady improvement in the quality of the wines marketed, such improvement being partly due to the introduction of grape varieties better adapted than the Mission grape to the production of wines suited to the taste of wine-drinking nations; partly to a real improvement in the methods of treatment, and their better adaptation to the peculiarities of California-grown grapes. Doubtless much remains to be done yet, especially in the latter respect, before the best possible results are produced; for heretofore the vintners of each of the five wine-growing nations represented in California have followed their native habits and methods of treatment, the outgrowth of the experience of each country under its peculiar circumstances of climate, soil, temperature, &c. It is rather to be wondered that so much good wine has even thus been produced in California as to overcome the prejudice engendered by the first crude products marketed, and on account of which most of the California wines have heretofore been sold under foreign labels.

Grape culture has also been introduced to a limited extent in Southern Oregon, where the European grape seems to succeed perfectly alongside of the American varieties. No wines made in that region have come to public notice; but reliable reports from competent persons state that the wines made resemble those of the Lower Rhine and Moselle, being much less heady and alcoholic, and more aromatic, than those of California. There is no obvious reason to doubt this statement.

DETAILS AND STATISTICS REGARDING THE WINE AND BRANDY INDUSTRY.

The total value of the grape crop of California for the year 1880, it is safe to say, from most reliable information, will fall but little, if any, below four millions of dollars. In round numbers the vintage for the same year reached over thirteen million gallons.

The following actual figures were obtained:

9,800,000 gallons dry wine, at 25 cents	$2,450,000
800,000 gallons sweet wine, at 60 cents	480,000
500,000 gallons brandy wine, at $1.20	600,000
75,000 boxes raisins, at $2	150,000
Green grapes, estimated	320,000
	$4,000,000

The estimate for green grapes includes those shipped, canned, dried, home consumption, and worked up by small wine makers, of which there is no record. It is far below the actual amount.

Wines received in San Francisco during the year 1880, 3,860,000 gallons; brandy, 233,000 gallons.

Wines shipped out of the State, 1880: By sea, 1,845,000 gallons; by rail, 1,250,000—total, 3,095,000 gallons.

Brandy: By sea, 98,200 gallons; by rail, 94,320 gallons—total, 192,5 gallons.

While the commission was unable to obtain exact data as to numb of acres of vineyards in the State, to place it at fifty thousand acr will not be considered an overestimate.*

Basing an estimate of increase for 1881 on personal observation what had been done, and that being done during investigation, I wou add not less than twenty-five per cent.

The whole of Sonoma County, except a narrow strip on the immedia coast, is well adapted to grape culture. From the southern to t northern extremity of the county the grape flourishes, and good, soun salable wine has been produced.

A very interesting and successful experiment of William Bihler, Lower Petaluma Valley, below Donahue Landing, has conclusively prov that the vine flourishes on the level with tide-water, as well as upon t red volcanic soil of the interior uplands. In view of Mr. Bihler's succe it may be justly claimed that the grape district of Sonoma County e tends from the shore of the bay of San Pablo to Cloverdale, and fro the summit of the Mayacmas Range, the eastern boundary of the count to within 40 miles of the sea-coast—a length of territory of 60 mile with a breadth of 25 on the average. Within this area there is a gre variety of soils and marked climatic differences, producing everywhe good wine, though varying in essential qualities, as in the delicacy bouquet and in color. There are in the county about 7,000 acres bearing vines, and at least 3,000 not yet bearing, of which 2,000 acre have been set during the past year.

From the best information obtained the wine product of this count for the year 1880 is as follows:

	Gallo
Sonoma Valley	1,400 00
Guillicos	150 00
Bennett Valley	100 00
Santa Rosa	200 00
Windsor	75 00
Knight's Valley	25 00
Sebastopol	20 00
Healdsburg	150 00
Geyserville	40 00
Cloverdale	30 00
Total	2,190 00

While there has been much damage by the phylloxera in some vineyards in Sonoma Valley, it is gratifying to note that there is an unusua product of wine for the year, and it has proved fatal only in the shallowest soil in the locality. A careful examination has shown that the insect has not appeared anywhere in this county, outside of Sonoma Valley proper, and there the extent of the injury, as proven by this year's product, is much less than heretofore supposed.

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* The figures here adopted by Mr. Furnas are those given by the report of the Stat board of viticulture for the year 1880. The returns of the census for the same yea differ so widely as to the product that no compromise is possible, the figures being o an average in the ratio of three to one. Total product, 10,600,000, according to th State board; 3,144,166, according to the census.

I cannot doubt that the census returns place the product too low; but leave the explanation of the discrepancy to the two parties concerned in making out the detail of the returns. From the fact that there is little difference in the vineyard acreage as returned in both cases, while the acceptance of the statements collected by the enumerators would place the product per acre at only about seven-tenths of a ton, instead of the minimum of two tons notoriously harvested as an average between young and old vineyards in the State, the probability is that the board's estimate is neare the truth.—E. W. H.

Any attempt to give the varieties of grapes grown in this county, in he confused condition of grape nomenclature, would be useless. The ld vineyards are mostly of the Mission variety, while those more recently et out are in the main the Zinfindel, Rieslings, Golden Chasselas, Traminer, Burger, Flame, Tokay, and other popular foreign varieties. This county was among the first to introduce and is perhaps more noted or wine industry than any other in the State.

At present but little attention is given to grape growing and wine making in the counties of Marin, Mendocino, Humboldt, Siskiyou, Trinity, Del Norte, and Lake. It is claimed that Lake County, particularly, is well adapted to vine growing, by reason of both soil and climate.

Some advantages for obtaining detailed information and data in Napa County were presented, and, as that and adjacent regions are regarded as more representative in vine interest than any other portion of the State, these advantages were utilized.

In Napa County there are nearly four hundred vineyards, ranging from 1 acre to 400 acres. There are over 11,000 acres in vineyards, 5,000 of which are in bearing. The number of vines in the county are 11,230,950.

There are 52 wine cellars, the product of which ranges from 1,000 gallons to 300,000 gallons each, making a total of 2,857,250 gallons. The brandy product of the county is reported at 60,000 gallons. Green grapes shipped from the county, principally to eastern States, amounted to 350 tons.

Solano County produced in 1880 175,000 gallons wine, and 15,000 gallons brandy. In addition large quantities of green grapes were shipped to San Francisco and the East.

In Contra Costa County but little is done. Mr. King thinks that 20,000 to 30,000 gallons of wine were made, and no brandy that he has any knowledge of. Here, too, we found phylloxera. The use of bisulphide of carbon has been found efficacious. The Riperia type of vines from Missouri, Kansas, Nebraska, and Texas are being planted, being considered phylloxera proof. It is claimed, and generally conceded, that the soil in this portion of the State is of the highest class for vineyard purposes, owing to the decomposition of lava and other volcanic rocks.

The number of acres planted to vines in the counties constituting the San Francisco district are:

	Acres.
San Mateo	225
Alameda	540
Santa Clara	1,451
Santa Cruz	430
San Benito	315
Monterey	125
Total	3,086

Nearly all these vines are in bearing, and are principally of the finer foreign varieties. The wine yield for the year 1880, so far as data could be obtained, was:

	Gallons.
San Francisco (from grapes bought)	250,000
San Mateo	9,000
Alameda	270,000
Santa Clara	584,000
Santa Cruz	172 000
San Benito	60 000
Total	1,345,000

The small wine makers, from whom no statistics were obtained, worked up large quantities of grapes in addition.

The quality of wines is all that could be desired. The varieties preferred for wine making are grapes belonging to the Burgundy class, such as Pinot, the Chabono, the Grenacke, Miller's Burgundy, &c.; and, if we are to judge from the quality of red wines produced from them, these grapes are possibly the best that could be planted in the counties of Santa Clara and Santa Cruz, where the peculiar soil brings out their characteristics in quite a remarkable degree. Beyond this these grapes—all maturing early, being excellent bearers, and giving a deep color to the claret they are made into, when properly handled—are just suited to the climate of these counties, which is cool, and where, therefore, the vintage would necessarily be late.

A number of vineyards in the district are suffering severely from a form of fungoid disease which checks the growth of the vine, causing it to languish and become unproductive.

Prices paid for grapes in the district have varied somewhat; those nearer the wine makers and their presses realizing the best, varying from $18 to $25 per ton.

There are only a few large wine-making establishments in the district, the smaller ones being the rule. From all sources I hear of renewed confidence in this pursuit, which has not only proved satisfactory during the last two seasons, but even quite prosperous.

Little opportunity for personal observation was afforded the commission in the greater part of the Sacramento district, from which grapes are very largely shipped to the East, as well as to home markets. The following data are furnished by the census of 1880, regarding the acreage and wine product of the counties included within it:

Counties.	Vineyards.	Wine.
	Acres.	*Gallons.*
Sacramento	1,938	44,865
Yolo	757	21,789
Sutter	169	8,335
Colusa	14	....
Butte	570	28,666
Tehama	39	72,300
Shasta	113	1,770

The products and acreage of these counties have doubtless been largely increased during the two succeeding seasons. In Tehama County alone a vineyard of about 1,000 acres has been established by Ex-Gov. Leland Stanford, in 1881–'82.

Much interest is being manifested in fruit culture in the San Joaquin district. The county of San Joaquin is generally level, with the lower foot-hills of the Sierra Nevada on its eastern border. It is estimated to contain 900,000 acres, fully one-half of it suitable for the growth of the grape. The price of the best vine land varies from $25 to $125 per acre, the highest price being for land in the immediate vicinity of the city of Stockton. The general character of the soil is clay and sandy loams, underlaid with marl, the water coming within 10 to 20 feet of the surface.

Most of the land can be irrigated or submerged, either from natural or artificial sources. The San Joaquin, Tuolumne, Stanislaus, Calaveras, and Mokelumne Rivers and their numerous tributaries, furnish abundant natural supplies, while artesian wells have been successfully sunk to the depth of 900 and 1,000 feet, respectively, at a cost of only $2 per foot, affording a copious supply of water for irrigating large areas of land.

So far, few viticulturists have deemed it necessary to resort to irrigation during the summer months, but a few have submerged their vineyards in the winter, thereby largely increasing their production, and securing immunity from the phylloxera. The climate of this county seems particularly adapted to the growth and health of the vine. The northwest wind during the summer prevents mildew and sunburn.

The first planting in this county was in 1850. Vines in full bearing range from 5 to 10 tons per acre, and sell at from $16 to $35 per ton. The annual cost of producing an acre of grapes does not exceed $10; gathering, $1.50 per ton.

Stanislaus County, like San Joaquin, is nearly level or slightly rolling land, upon its eastern border. It contains 800,000 acres, a large portion of it good vineyard land.

The acreage in vines is placed by the census at 99 acres in 1880. The grapes grown compare favorably with those of other localities, the largest vineyards being in and around Knight's Ferry. Good grape lands are worth $15 to $50 per acre, according to location and easy access to market. Nearly all the vineyards are irrigated by means of ditches or canals. H. B. Pentland, of Knight's Ferry, reports 25 to 30 acres in vines, and large quantities of suitable land in that vicinity. All varieties do well when irrigated, and no diseases trouble the vines. Joseph Dominici and V. E. Bangs report the same, in substance, except that they do not irrigate.

The Red Mountain Vineyard contains 70 acres, two-thirds of which are of Mission, the remainder of Muscat and Zinfindel, all producing large crops. Large quantities of land, with good facilities for irrigation, can be bought in this locality for from $10 to $20 per acre. The grapes ripen early, and are seldom injured by late frosts. Pasturing sheep in the vineyard to keep down insects, especially the vine hopper, is recommended by Mr. Shell.

Fresno County is one of the largest in the State, embracing an area of 5,200,000 acres, mostly a sandy loam, a large portion of it arable, and at least 871 acres in vines. The natural facilities for irrigation are numerous and excellent, and artesian wells, bored to the depth of 150 to 300 feet in many places, supplement the water supply. A great number of colonies dot the county with settlements devoted to fruit and grape culture, the Central Colony being especially devoted to raisin culture. All irrigate, and the industry promises great developments in the near future.

Dr. F. T. Eisen commenced planting in 1873; has 179 acres in bearing, mostly wine grapes, comprizing the Zinfindel, Riesling, Hamburg, Malvoisie, Muscat, and Fisher Zagos varieties. T. C. White, of the Central Colony, has a vineyard of 30 acres, all of the Muscatella and Gordo Blanco, which are devoted exclusively to raisins. W. B. Banister, Central Colony, has five acres in Muscatella. Miss M. F. Austin, of the Hedgerow Vineyard, Central Colony, cultivates 30 acres in Muscats, Gordo Blanco, and Seedless Sultana. Thousands of acres can be obtained in that vicinity at $5 to $50 per acre.

Dr. Eisen is quite extensively engaged in wine and brandy making. His product for the year 1880 was 50,000 gallons wine, and 4,000 gallons of brandy. Besides his own grapes he purchases, paying $20 to $25 per ton. His products are disposed of at San Francisco mainly. Prices obtained: For sherry, 75 cents per gallon; port, 60 cents; and claret, 40 cents. No brandy yet sold.

Merced County, in topography, soil, and climate, greatly resembles the counties above named. The area embraces 1,000,000 acres, nearly all susceptible of cultivation, and much of it adapted to the growth of the grape. The number of acres devoted to its culture is about 178, according to the census of 1880.

The El Dorado district comprises near the entire Sierra Nevada range in the State. The soils are nearly the same—what may be classed as second and third rate. The eastern portion of all the counties, embracing more than one-half of the area, is unfitted for the vine from climatic disabilities; but the western portion of all these counties, or what is commonly known as the "foot-hills," is particularly adapted to the vine. It varies from a gray sandy, a volcanic brick color, to a brown slaty, the shallowest being 2½ to 3 feet, the deepest 8 to 10 feet, in depth.

In El Dorado County there are between 1,000 and 1,200 acres now in bearing vines—1,415 in all, according to the census. The average number to the acre is 800. These produce on an average of two tons to the acre of grapes. The proportions and kinds growing—taking 100 as the sum—are as follows: Mission grape, 68; Catawba and Isabella, 10; White Muscat, Muscatella, Malaga, 6; Tokay, Black Morocco, Malvoisie; 1; Zinfindel, Riesling, 2. The other thirteen are made up of numerous other varieties, such as Sweet Water, Black July, Hartford Prolific, Cloantha, and Concord, and some others.

One thousand four hundred and fifteen acres of vines have been planted in El Dorado County, according to the census of 1880. The Mission or the wine grape is the most prolific bearer. The number of gallons of wine produced will not fall short of 350,000; brandy, about 150,000. There are from 75 to 150 tons of grapes used for raisins. Grapes for wine sold at a uniform rate of $15.50 per ton, table grapes at from 3 to 8 cents per pound. The vine throughout the district is healthy. Investigations prove that vines upon shallow, clayey, adobe, and black soils are infested with phylloxera, but to no considerable extent; in fact, the presence of this pest is barely noticeable.

In Nevada, Placer, Amador, Calaveras, Tuolumne, and Mariposa Counties the conditions of soil and climate are about the same as El Dorado. In Nevada County the number of acres of vines, taking small with larger growers, is about 400. In Placer there are about 850 to 900 acres; in Amador County, about 600 acres; in Calaveras, about 400 acres; Mariposa, about 500 acres, as near as I can learn; Tuolumne, about 400 acres.

The varieties of vines grown in these counties are about the same as in El Dorado, as well as the average yield, and the amount of wine and brandy made is about in the same proportion to the number of acres planted as in El Dorado. The phylloxera has also made its appearance in the vineyards of Placer, Nevada, Amador, and Calaveras. In Yuba, Sierra, and Plumas Counties there are many of the healthiest vineyards in the State, though small in comparison. Inyo, Modoc, Mono, Alpine, and Lassen have not given much attention to this industry, although the soil and climate of many portions of all these latter counties are susceptible and fitted to vine growing. There are hundreds of thousands of acres of the very best vine-growing land in the State that can be had for the taking. Improved lands, in bodies of from 100 to 300 acres, where from three-fourths to four-fifths of the whole are suitable for vineyards, can be purchased at from $10 to $30 per acre, in many cases with a vineyard of from 5 to 10 acres already planted. The physical qualities of the soils exerted upon by the atmosphere above, subterranean water currents below, taken with the physical properties of the soil and its rich chemical constitution, from experiments already made, make the "foot-hills," with the cheapness of the lands, the most desirable and advantageous outlook for California's future vineyards. The "foot-hill" grape is said to have a superabundance of sugar for a superior quality of wine, but this is shown to somewhat decrease with cultivation. It is desirable in planting vines to avoid shallow clay and bed-rock soils, to seek the sandy, porous, and easily pulverized ground, with the vine fair to sun during the whole day.

The whole country composing the Los Angeles district, except at and close by the old Missions—Los Angeles, San Gabriel, San Bernardino, San Diego, and Santa Barbara—may be called new. Nine-tenths of vine-growing to date is found in Los Angeles and San Bernardino Counties. The wine and brandy manufactory of Stem & Rose, in Los Angeles County, I take as representative of these industries in the district. Beside their own vineyard, consisting of several hundred acres bearing, they handled, as their books show, 1880, over 12,000,000 pounds of grapes. In round numbers, the wine produced was 400,000 gallons, and brandy 100,000. I found them in the mid-season of this year's operations, and therefore could only learn that it would be largely in excess, in all respects, over the year past. As an evidence of increase in vine-planting, I mention, as obtained from the foreman, that from Mr. Rose's vineyard there were sold for planting, 1881, over 800,000 grape cuttings. They were paying $20 per ton for grapes, the yield averaging four tons per acre.

In former years Los Angeles had the reputation of being especially adapted for making port, angelica, sweet muscat, and brandy; but in light wines the county stood last on the coast. The writer never shared in that belief, for, if the Mission grape attained a higher and more perfect maturity, and made a wine of the best quality for which it was adapted, I could not see why other varieties of grapes, which were suited for other kinds of wine, should not, also, when ripened in our genial, pleasant climate, make a wine—a light wine—characterized by a bouquet of the best quality. It is now an admitted fact that no country, no difference how well adapted for growing grapes of the best quality for making the most superior wines, will make equally good wine from all kinds of grapes. In order to make the best quality of wine, such localities must also have those varieties of grapes that make the best quality of wine. Johannisburg, without the Riesling, would soon lose its reputation for its fine quality. Plant Chateau Lafitte with the Mission grape, and the time would not be long when its name would drop out of existence as a locality for fine clarets.

Perhaps there is no locality in California which is so little understood as to climate as Los Angeles and other southern counties. Summer heat is much less, and nights much cooler, than at either Stockton or Sacramento. Here they have but little hot weather, but a more even temperature, warmer winters, and a longer season. As this is the home of the orange, lemon, and other like fruits, the mistake is a natural one, but they excel in raising these, not because they have a greater summer heat, but because of a warmer winter and a more even temperature the whole year. It is no longer an experiment whether they can make a light wine of the best quality. It is a fact accomplished, a fact which all viticulturists who have tried their wines admit. Mr. Rose says he can show wine in quantities which only carries seven per cent. of alcohol, and can be drank with pleasure when one is dry to quench thirst, and leave no dullness of the mind behind. Of course this cannot be done with the Mission grape, and the verdict founded on that grape has been a just one, which said that we could not make a light wine, and that all our wines had a sherry flavor. The planting of other varieties of grapes, however, tells a different tale. The Blanc Elbea, Burger, Zinfindel, and Charboneau changes this verdict, which was based upon wine of every kind and variety made from our grape, viz., the Mission.

In San Bernardino County there are vineyards owned by Dr. Barton, Mr. Crafts, Mr. Pain, Dr. Edgar, and Mr. Pishon, amounting to about 200 acres. There is also an awakening to viticultural interest in Ventura and San Diego, all of which are buying the finer varieties of grape cuttings for planting. Riverside has many small vineyards, planted generally with Muscat of Alexandria, and Muscatella Gordo Blanco, from which a very fine quality of raisins is made.

There are about three hundred parties engaged, somewhat extensively, in grape-growing in Los Angeles County. Among them I had the honor of meeting General Stoneman, the cavalryman of late war notoriety. He has 200 acres in grapes and 20 in citrous fruits. J. De Barth Sherb, president of the Southern Horticultural Society, is largely engaged in grape-growing and wine-making. E. J. Baldwin, of San Francisco, has 300 acres in bearing vineyard, and 700 acres more planted, not yet bearing. His books show 150,000 gallons wine made, 1880, and 25,000 gallons brandy.

Lands range from $10 to $200 per acre. The "foot-hills," or mountain slopes, range the lowest, and yet for grape culture are regarded of high degree.

CALIFORNIA WINES AND BRANDIES.

By E. W. HILGARD.

NOTES ON THE REPORT OF A COMMITTEE ON CALIFORNIA WINES AND BRANDIES, EXHIBITED AT THE FAIR OF THE MECHANIC'S INSTITUTE, SAN FRANCISCO, IN 1878.

Owing, in part, to depression of the wine interest, native wines for several years formed no prominent part of the exhibits at the several fairs in the State. At the twelfth exhibition of the Mechanics' Institute of San Francisco, in 1877, no wine was exhibited. In the following year (1878), at the suggestion of Rev. Dr. J. I. Bleasdale, of Australia, an invitation was issued by the managers to wine-producers, to send samples of their best products for adjudication by a committee of experts appointed for the purpose. This committee consisted of the following gentlemen: Dr. J. I. Bleasdale, of Melbourne, Australia; Drs. H. H. Behr, Charles Bertody, and Wm. Hammond; Messrs. B. H. Redding, and Adolph Herbst, of San Francisco, and myself. The diversity of national and individual tastes thus represented seemed to insure an impartial consideration of the intrinsic merit of the native wines. It was agreed from the outset that the unmistakable peculiarity of all California-grown wines (what is often called their "earthy taste") should be taken for granted, and their quality determined, not with reference to any particular standard of foreign wines, but upon their own merits, as much as the preformed tastes of the judges would allow.

Forty-three samples of wines from various parts of the State were sent in, and not only tasted, but also subjected to distillation and various other tests, by Dr. Bleasdale, whose painstaking investigation of Australian wines, in an official capacity, had specially qualified him for this examination. Five sittings were held by the committee, and the results published in tabular form, in the official report of the thirteenth exhibition of the Mechanics' Institute, in conjunction with a highly valuable treatise on the whole subject of wine-making, by Dr. Bleasdale. In this he considers especially the treatment of wines in Portugal, as the climate most nearly alike to that of California, and calls attention to a number of points of importance heretofore, in a great measure, overlooked by California wine-makers.

In classifying the various wines, it was agreed by the committee that the labels of all bottles should be effectively covered until after the vote was recorded. That the highest number of marks allotted to any wine should be 20; that all wines falling between 17 and 20, on averaging the marks of the several members, should be classed as No. 1; all those similarly falling between 14 and 16, inclusive, should be classed as No. 2; and those between 10 and 13, inclusive, as No. 3. Those falling, in the judgment of the committee, below 10, should be excluded from consideration. The points recorded separately by each member were the following:

1. Date of vintage.
2. Color of the sample.
3. Condition.
4. Flavor.

5. Bouquet, both as to quantity and quality.
6. Body—light, medium, or full.
7. Acidity felt by the palate.
8. Value of the sample, in numbers.

The absolute acidity of the samples and the proportion of tannin contained, were also simultaneously demonstrated by chemical tests. The general results were as follows: Of the forty-three samples examined, thirty-two were placed in the first class; one only, however, receiving the maximum of 20 marks, almost unanimously; eleven were placed in the second class, on the average of marks; none in the third class; unanimously, none in the fourth class.

It should be added that the favorable results were a surprise to most of the members of the jury, who had, it appears, not generally come in contact with native wines of this quality, and hardly believed in their existence. This circumstance adds to the value of their decision.

The following table shows in part the results of the labors of the committee:

Classification of samples by the jury.

Name of district and locality.	Name of grower.	Number of samples sent by exhibitor.	Name of wine.	Color.	Date of vintage.	Classification by the judges.		Retail selling prices in San Francisco.	
						Second.	First.	Per gallon.	Per dozen.
Mission San José	Mr. Koene, (Exhibited by Mr. Woods.)	....	Burgundy	Garnet red.	1876	....	1	....	......
			Zinfindel	Purple	1877	....	....	....	......
			Malvoisie	Red	1876	....	1	....	......
Stanislaus County.	Mr. Palmer, San Francisco.	2	Frontignan	Amber	......	1	...	$2 50	$5 50
			Port	Red	......	....	1	2 50	5 50
Calistoga (Schramberg).	Mr. Schramm	2	Schramberger white.	White	1874	....	....	....	......
			Schramberger red.	Garnet red.	1875	....	....	....	......
Upper Sonoma Valley.	Kohler and Frohling.	....	Port	Garnet red.	......	....	1	2 @ 4	5 @ 10
			Tokay	Brown	......	....	1	1 50	5 00
			Angelica	Amber	......	1	..	2 00	6 00
			Riesling	Straw	......	....	1	1 25	4 00
			Zinfindel	Purple	......	....	1	1 25	4 00
			White wine	Amber	......	1	....	1 00	3 50
			White	Yellow	......	....	1	1 00	3 50
Sonoma	Mr. Gundlach	8	Gutedel	Golden	1870	....	1	....	7 00
			Gutedel	Golden	1875	1	....	1 25	6 00
			Claret	Purple	1874	....	1	1 50	4 50
			Young claret	Garnet red.	1876	1	....	1 50	4 00
			Riesling	White	1875	....	1	1 25	6 00
			Traminer	Pale white.	1874	....	....	1 50	6 00
			Another sample	White	1874	1	....	1 50	6 00
			Riesling	Yellow.	1874	....	1	1 50	6 00
Napa and Saint Helena.	Mr. Groezinger.	8	White wine	White	1875	....	1	1-1 25	3-3 50
			Claret	Ruby	1875	....	1	1-1 25	3-50-4
			Angelica	Straw	......	1	...	2 00	4 50
			Another bottle	Golden	......	1	....	....	......
			Sherry	White	.	1	...	2 00	4 50
			Zinfindel	Red	1874	....	1	1 25	3 50-4
			Sherry	White	1874	....	1	2 00	4 50
			Traminer	White	1875	1	....	1-1 25	3 50-4
Sonoma (four miles from the town of Sonoma).	Col. G. F. Hooper.	11	Table claret	Purple	1876	1	....	0 45	....
			Table claret	Ruby	1874	....	1	0 65	4 50
			Table claret	Purple	1876	....	1	0 45	......
			Zinfindel	Purple	1877	1	....	....	......
			*Claret	Ruby	1874	....	1	0 65	4 50
			Mission	Golden	1873	....	1	1 00	6 00
			Tokay	Yellow	1874	....	1	1 00	6 00
			Light claret	Ruby	1875	....	1	0 55	......
			Chablis	White	1874	1	....	1 00	6 00

Classification of samples by the jury—Continued.

Name of district and locality.	Name of grower.	Number of samples sent by exhibitor.	Name of wine.	Color.	Date of vintage.	Classification by the judges.		Retail selling prices in San Francisco.	
						Second.	First.	Per gallon.	Per dozen.
Sonoma............	Col. G. F. Hooper.	11	Medium claret ...	Purple..	1876	1	....	$0 45	......
			Young claret.....	Purple..	1877	....	1	....	......
	Landsberger & Co.	12	Mission	White ..	1866	....	1	....	......
			Mission	Golden .	1869	1	....	....	......
			White Zinfindel..	White ..	1876	....	....	....	......
			Riesling..........	White ..	1876	....	1	1 00	$5 00
			Noble wine	Golden..	1875	....	1	....	......
			Young Zinfindel	White ..	1877	....	....	....	......
			Mission and Blendsfit.	White ..	1876	1	....	0 75	3 50
			Do	White ..	1876	1	....	0 75	3 50
			Do	Garnet red.	1877	....	1	0 60	3 00
			Do	Straw...	1869	....	1	....	......
								Q'rts.	Pts.
			Eclipse champagne.	White ..	1869	....	1	$14 00	$15 50
			Port.............	Ruby ...	1874	....	1	1 50	6 00

* This wine is the only sample that received the full number of 20 marks.

The following points were noted by the committee, although they were not made a special matter of official record:

The wines were in nearly all cases rather heavier—richer in alcohol—than is usual in the wines in daily use in wine-drinking countries. This is more especially true of the wines made from Mission grapes, which at the same time are deficient in the "bouquet," and only acquire it to some extent by age. The red Mission wines are, on the whole, decidedly superior to the white; a circumstance easily accounted for from the fact that the Mission grape is remarkably poor in acid, which is necessary to the development of the bouquet, and of the higher qualities of wine generally.

I have heretofore suggested that this peculiarity might, in a measure, be modified by not allowing the grape to become as "dead ripe" as is now usually done. This would tend to increase the acid at the expense of the sugar, which is in excess at best, thus producing the excessive headiness for which Californian wines are thus far noted. The vintners object to this course on the ground of the European precedent, according to which every additional day of sun is accounted so much gain to the quality of the wine. But what is true in the cloudy climate of Europe is not, therefore, necessarily true in sunny California. To suit the taste of the wine-drinking nations, we must aim to produce not the fiery, but relatively flavorless wines of Southern Spain and Italy, but something more like the universally accepted wines of Middle and Northern France; and this cannot be done under the glowing sun and cloudless sky of the interior of California, unless the nature and treatment of the grapes and wine are correspondingly modified.

A correct appreciation of this necessity has led to the introduction on a large scale of the tart, acid, and highly colored Austro-Hungarian "Zinfindel" grape—the opposite extreme as compared with the Mission. Even under the fervid sun of California, the pure product of this grape remains too harsh for most palates; but its mixture with the Mission (before fermentation, of course) produces an admirably blended product, in which the faults of both have become virtues; and among such blends were some of the finest red wines sampled and tested by the committee. Of course, the combination of the acid and body-yielding Zinfindel with grapes of higher quality than the Mission may be made to produce still finer results. It remains to be seen whether in succeeding generations, under the influence of the Californian climate, the foreign grape varieties will not themselves gradually become modified in the same direction as the Mission grape. At all events, the committee were satisfied that one of the most important points to be more fully studied by California wine-makers is the proper blending of the several grape varieties in the must as well as subsequently in the cask. The objections sometimes made to this process are, of course, a pure matter of sentiment, and as such are scarcely ever taken into account by intelligent wine-makers, who are well aware that even the best grape will rarely produce a palatable wine unless intelligently treated, and that, with few exceptions, the best wines in the world are judiciously made blends, whether of different grape varieties or of the product of vineyards differing in the peculiarities they impart to the product.

It follows from the above considerations that wine-making, like any other technical process of manufacture, requires special training, and in a measure a natural ability, as regards taste, to produce the best possible results from under given circumstances. Hence the establishment of large wineries, conducted by persons specially qualified, would tend to improve the quality of wines, as against the practice of establishing a costly plant for each small vineyard, whose proprietor is not versed in the difficult art of wine-making.

Again, it has been the practice to put on the market, under the names of port, sherry, &c., wines whose only resemblance to their prototypes consist in a superficial resemblance of color, sweetness, and alcoholic strength, but lacking both the body and flavor of the originals. It should be distinctly understood that the production of these wines is dependent both upon the peculiarities of the countries and the localities where their prime materials grow, and upon definite processes of manufacture, without which their character cannot be reproduced. Especially as regards port, the defects of the Californian practice are very clearly set forth in the treatise of Dr. Bleasdale, mentioned above. There is especially one point of radical importance, namely, thorough aeration of the must by the treading process, which evidently exerts a decisive influence upon the product. The aeration can, of course, be effected otherwise than by treading, but without it neither port nor sherry is likely to be produced anywhere, and the labeling of weak imitations with their names can but depress the public estimate of California wines.

The same point, namely, aeration, will probably need attention in connection with other, especially white wines, whose keeping qualitities appear to be frequently injured by "overfining," practiced evidently for the purpose of improving an unsatisfactory condition (as to clearness or "brightness"). The removal of the tannin, resulting from this process, is a most serious detriment to the keeping qualities of the wine, as well as to its palatableness. It was also noticed that the use of inferior corks had, in a number of cases, injured the flavor of otherwise excellent wines.

Finally, it was a matter of remark that but few of the wines examined were of sufficient age to have developed their best qualities, and that in not a few cases the promise of the sample, under proper treatment, considering its juvenile age, would have placed it much higher than its present condition would warrant.

CALIFORNIA BRANDIES.

While in Northern California brandy has thus far been chiefly made of the pressed pomace, producing a somewhat rank-flavored liquor, that of Southern California is mostly made from unpressed pomace, or crushed grapes from which the "first run" only has been taken, and is therefore on the whole superior, although made almost entirely from the Mission grape. A few wineries in Northern California also distill their lower-grade wines, in part at least made from foreign grapes, and put into the market excellent products. One establishment only, thus far, has made a specialty of making high-grade brandies from winess specially prepared for the purpose from grapes known to be adapted to this end, viz., that of General H. M. Naglee, of San José. The brandies so made contain, of course, the minimum amount of the rank and fusil oils supplied by the pomace, which so materially heighten the deleterious effects of excessive use attributable by their action on the brain.

After the conclusion of its labors on wines, the committee above mentioned held several sessions for a comparison of samples of grape brandies, most of which were furnished by General H. M. Naglee, of San José, while others were procured in the general market.

General Naglee, after a study of the processes of brandy manufacture in the various districts of France noted for their product, concluded that it was possible to manufacture in California better brandies than those of Cognac; the increased value of wines having almost entirely done away with their distillation for brandy in France. He has, therefore, for nine years past, distilled brandies from young wines made from various kinds of choice grapes, such as Charbonneau, Folle, Blanche, Riesling, &c., using therefor a still specially devised, by means of which he frees the distillates from the fusil oil to any degree desired, and thus produces a liquor as nearly free as possible from all but the finer flavors, and therefore better adapted to *bona fide* medicinal use than any other spirits now attainable in commerce, and capable of replacing advantageously the too frequent use of opiates in ordinary cases. The price of such products must of necessity always be too high to place it within the reach of many of those who make a daily beverage of strong liquor; and yet such spirits would be less injurious than those now in ordinary use, at least to the same extent that corn whisky is less fatal in its action brandies with those now usually obtainable under the name "Cognac" on the brain and nerves than "absinthe." A comparison of such pure will generally result in the rejection of the latter by any cultivated palate. The example set by General Naglee, in freeing the brandy as much as possible from the deleterious fusil oils, will establish for the Californian product the precedence over the much-doctored imported liquors.

COMPOSITION OF CALIFORNIA MUSTS AND WINES.

The subjoined tables show the results of analyses made in the viticultural laboratory of the agricultural department of the University of California of wines made in the laboratory itself, from grapes obtained in different portions of the State, in 1880. A similar and more extended series is being made of the vintage of 1881. These investigations have been made by Mr. F. W. Morse, viticultural assistant, and will be published with full discussion in the report of the college for the year 1882.

No. 1.—The first grapes used for making wine were the Mission grapes, sent by Dr. J Strentzel, of Martinez, about October 10. They were picked when only just ripe, in order to compare them with grapes from the same place when fully ripe, and containing maximum amount of sugar. They arrived in good condition, and were immediately stemmed and crushed, and one-half made into red, the other half into white, wine. Fermentation began on the 14th of October, and on the 23d the red wine was pressed from the pomace. Both wines were racked off from their lees November 26.

No. 2.—Zinfandel grapes, from Mr. C. Krug, Saint Helena, sent October 22. They were very ripe and soft. They were treated in a similar manner to No. 1. Fermentation began on the 23d of October, and the red wine was pressed on the 31st. November 29 the wines were racked from their lees.

No. 3.—Malvoisie grapes, from Mr. C. Krug, Saint Helena, sent October 28. They were just ripe and in good condition. They began fermenting on the 29th, and the red wine was pressed on the 8th of November; on the 9th of December they were racked.

No. 4.—Pineau of Burgundy, sent by General H. M. Naglee, San José, October 30. They were packed in large barrels, and had been delayed on the road, so that when received they were in bad condition. The juice had run from the loose grapes so that it was impossible to determine the proportion of juice and pomace in the grape. The best ones were taken for making white wine. Fermentation began on the 1st of November; on the 11th the red wine was pressed, and on the 28th both wines were racked from their lees.

No. 5.—Burger grapes, from Mr. C. Krug, Saint Helena, sent November 4. The grapes were in a very bad condition; many had already soured and could not be used. Fermentation began on the 4th of November. The "red" wine was pressed November 13, and both wines were racked off November 28.

No. 6.—Mission grapes, fully ripe, sent by Dr. J. Strentzel, Martinez, November 10. They were in very good condition. Fermentation began on the 12th of November; on the 22d the red wine was pressed, and racked December 15.

The must from some other specimens of grapes has been analyzed, but no wine was made from them.

Name.	Color of wine.	Total weight, in pounds.	Pomace, per cent.	Stems, per cent.	Gallons of must.	Temperature of must.	Specific gravity of must.
						°	
Mission (just ripe)	White					24	1.085
Do	Red	71.75	13.5	3.05	6.95		
Mission (fully ripe)	White	106.5	18.3	3.75	9.2	13.5	1.085
Do	Red	101	11.63	3.96	9.4		
Mission	White					16.5	1.100
Zinfindel	White	84	27.3	5.75	6.2	18	1.086
Do	Red	126	13.4	5.55	11.2		
Zinfindel (second crop)	White					22	1.080
Malvoisie	White	116	18.1	2.58	9.9	19	1.110
Do	Red	151	10.92	2.65	14.1		
Charbonneau	White	97	30.92	6.18	7.0	20	1.050
Do	Red						
Burger	White	74	22.97		6.4	19	1.085
Do	With skins	95	12.1	7.36	8.6		

Name.	Color of wine.	Solid contents, by spindle.	Residue by evaporation, per cent.	Grape sugar, by polarization.	Fruit sugar, by polarization.	Total sugar, by copper test.	Acid calculated as tartaric acid.	Amount of standard alkali solution to neutralize ten c. cm. of juice.
Mission (just ripe)	White	16.2	16.32	6.55	10.22	16.77	.414	.552
Do	Red						.281	.375
Mission (fully ripe)	White	20.4	20.05	9.46	13.64	23.1	.458	.610
Do	Red						.360	.480
Mission	White	23.75	23.68	7.54	16.15		.375	.504
Zinfindel	White	21.06	Lost	7.08	12.48	19.56	.405	.540
Do	Red						.894	.222
Zinfindel (second crop)	White	14.66	15.16	7.81	11.32	19.13	.756	1.008
Malvoisie	White	25.87	22.24	12.05	16.71	28.76	.338	.450
Do	Red						.295	.393
Charbonneau	White	12.25	11.44	4.81	7.59	12.4	.657	.876
Do	Red						.563	.750
Burger	White	15.83	13.28	6.51	9.06	15.56	.677	.903
Do	With skins						.75	1.000

Name.	Color of wine.	Specific gravity.	Specific gravity of dealcoholized wines.	Solid, by spindle.	Solid, by evaporation.	Organic matter, per cent.	Ash, per cent.
Mission (just ripe)	White		1.055	1.375	1.228	.998	.230
Do	Red	1.000	1.005	1.25	1.638	1.320	.318
Mission (fully ripe)	White	.995	1.0055	1.375	1.750	1.506	.244
Do	Red	.995	1.007	1.750	1.919	1.522	.397
Zinfindel	White	.9925	1.0055	1.375	1.548	1.362	.186
Do	Red	.9975	1.007	1.750	2.339	2.047	.291
Malvoisie	White	.990	1.065	1.625	1.751	1.435	.316
Do	Red	.995	1.008	1.200	2.619	2.282	.337
Charbonneau	White	.9975	1.004	1.000	1.325	1.121	.204
Do	Red	1.000	1.0055	1.375	1.855	1.536	.319
Burger	White	.995	1.005	1.250	1.505	1.335	.170
Do	With skins	1.000	1.0055	1.375	1.758	1.528	.231

Name.	Color of wine.	Alcohol, vol., per cent.	Alcohol, weight, per cent.	Total acid as tartaric acid.	Bitartrate.	Actual tartaric acid.	Sugar.	
							Degrees of polarimeter.	Per cent. by copper test.
Mission (just ripe)	White	10.0	8.0	.537	.1550	.1550	......	......
Do	Red	8.5	6.8	.540	.0564	.0111	......	......
Mission (fully ripe)	White	12.8	10.3	.349	.2300	.1776	......	......
Do	Red	13.3	10.8	.330	.1220	.0629	......	......
Zinfindel	White	12.6	10.2	.600	.1739	.0888	......	......
Do	Red	12.9	10.4	.390	.0470	.0370	......	......
Malvoisie	White	16.7	13.5	.427	.0517	.0592	......	......
Do	Red	14.5	11.7	.246	.0423	.0259	......	.086
Charbonneau	White	8.1	6.5	.475	.1598	.1295	......	......
Do	Red	6.5	5.2	.442	.2068	.1184	......	.06
Burger	White	9.0	7.2	.562	.0987	.1591	......	......
Do	With skins	9.2	7.3	.525	.0376	.0222	......	......

RAISIN-MAKING.

By R. W. Furnas.

As raisin-making is comparatively a new industry in connection with vine-growing in California, and I may say a very important and successful one, I give the experience of R. B. Blowers, who has established a reputation as a raisin-maker, in his own words:

Raisins are made from the Muscatella, Gordo Blanco, and Muscat of Alexandria, preferably of the former; also a seedless raisin, highly esteemed, made from the Seedless Sultana. The grapes should be allowed to remain on the vine until quite ripe, showing a yellowish or golden color, and being more translucent than when too green. Then they should be carefully picked and placed upon a drying-tray (usually 2 by 3 feet in size), then exposed with an inclination toward the sun in some convenient place, generally between the rows in the vineyard or in some contiguous open land. After having been exposed a sufficient time to become about half dried, they are turned once in this manner, viz: two workmen, taking an empty tray, place it upon a full one, holding them together firmly, and with a swinging motion turn them over and replace the now turned grapes in their former position. The turning should be done before the dew is quite off the grapes, in the early morning; then, when the grapes have become so dry as to lose their ashy appearance, some being a little too green and some quite dry enough, they are, after removing those entirely too green, slid from the tray into large sweat-boxes, having a thick sheet of paper between about every twenty-five or thirty pounds of raisins; then they are removed to the storeroom, where they should remain two weeks or more. When ready to pack, it will be found that the too moist ones have parted with surplus moisture, which has been absorbed by the stems and drier raisins. The stems are now tough and the raisins soft and ready to pack. They are carefully placed in packing-frames made of steel or iron, the large and fair ones being placed carefully in the bottom of the frames, the surplus stems and imperfect berries cut away; then the average raisins arranged in and weighed, placing five pounds in each frame, then pressed enough to make them firm in the frame, but not enough to break the skin. They are then passed to an inspector, who examines the exposed side of the raisins, removing any imperfect ones; then placing the wrapper paper on the frame, holds it in place with a wooden or steel plate, turns it bottom up, drops the left end into the box, slides the plate quickly from under the frame, and it drops into the box; then pressing slightly upon the movable bottom of the frame, the the frame is removed; the bottom of the frame is then pressed more firmly, to cause them to fill the space formerly occupied by the sides and ends of the frame; then it is removed, and the face of the latter is exposed; all imperfect berries or too wet ones are removed, and all vacancies or hollows filled by large loose raisins. The label of the proprietor is then placed on the face; the ends of the wrapper, and then the sides, are folded over, the box cover nailed on, and they are ready for market.

The complaint is somtimes made that the California raisins have too tough skins, too large and too many seeds, lose flavor in cooking, lose their bloom, and do not keep well. The most of these objections arise from an imperfect knowledge of the best varieties from which to make them. If Californians would confine themselves to varieties which centuries of experience have proved to be the best in Europe, there would be more satisfaction in the result.

Cultivation, irrigation, local climate, kind of soil, and exposure to sun all have an influence in modifying the characteristics of any one variety. Virgin soil and vigor of vine may make the seeds fuller, as it does in all cereals, but it should not, other things being equal, make skins thicker, but the contrary.

Soil for raisins, a rich, sandy loam preferred; climate, warm; soil, moist; winter irrigation in average years being quite as important as summer in our dry valleys. For safety against many kinds of insect pests, the phylloxera especially, a location is desirable where water is plenty and evenness of land surface permits winter submersion. In such favorable locations a larger berry, thinner skin, better yield, &c., will be the result. The vines are planted 8 by 8 feet in many locations, but growers of the greatest experience prefer a greater distance apart; some plant 8 feet by 10, some 10 by 10 feet, thus giving greater vigor to each vine, enabling it to resist enemies of all kinds more surely.

Irrigation is a very important factor in the success of the fruit-grower, but if the situation is good in other respects, and no ditch water can be secured, it is found that in many parts of the State an unfailing supply lies but a small way beneath the surface, in gravel ridges. Former water-courses having been filled with gravel, the surface stream diverted sometimes many miles away, leave quite a large flow of water in the gravel. This being tapped by a well, the only equipment needed is a straw-burner engine and rotary pump; and 100 or more acres can be irrigated with economy, insuring a good profit and a pleasant home.

In an experiment made recently in Yolo County, after having submerged the entire vineyard for nearly two weeks, such a well being on the place, the ditch water was shut off from twenty acres of the vineyard, and while the water still covered the entire surface to the extent of over 19 acres, the pump was run five hours, supplying the seepage and raising the water five-eighths of an inch over the entire surface, showing that in twenty-four hours 3 inches in excess of the seepage could be added to nineteen acres after the ground had been saturated.

Cost of planting and cultivating, irrigating, labor, subsistence, &c., including total expenses for first year, is from $20 to $25 per acre, if thoroughly well done; second year, $15 to $20; third year, many varieties if well cared for yield a profit; if not well attended to it may take a year or two longer. Nothing pays better than care, and nothing loses more surely than negligence in vine-growing. In pruning, the habit of each variety grown should be closely studied. In grafting great care should be taken to choose stock with wood of similar growth. If the variety desired is a coarse wood and large grower, a similar stock should be selected; if wood is of fine texture and slow growth, a wood of fine texture should be selected as grafting stock.

As the commission particularly desired data concerning the feasibility of raisin-making in California, I endeavored to give to it particular attention. As Mr. Blowers is regarded as an authority, and a representative man of the raisin industry, I endeavored to learn from him all there is of it. He has 40 acres of grapes in bearing. The gross proceeds from this has been as high as $17,000 in a single year; expenses about $7,000, leaving him a net profit of not less than $10,000. His average raisin yield per acre runs from 180 to 200 boxes; 20 pounds to the box. His best yield was 4,800 boxes, from 20 acres. Mr. Blowers' raisins bring him an average of $2.20 per box.

The famous and extensive raisin vineyard of Briggs is near that of Mr. Blowers, in Yolo County.

Miss M. F. Austin, at Central Colony, Fresno County, has 30 acres, young vines, in raisin vineyard, yielding 100 boxes to the acre, for which she receives $2 per box.

Great attention is being given to the raisin industry at Riverside, in San Bernardino County, where they claim many superior characteristics. The specimens of raisin grapes and raisins made at Riverside were as fine as were found anywhere else in the State.

At Pasedana, Los Angeles County, the surroundings for successful raisin-growing is admirable, and already considerable attention given. Mrs. Carr, wife of Prof. E. C. Carr, former professor of agriculture in the California State University, I found making raisins on the Spanish plan of drying on the ground.

Over 100 tons of grapes were used in the year 1880 for raisins in El Dorado County. Principally, as elsewhere, they were dried in the sun; some few by artificial heat, in evaporators.

Dr. Conger, of Pasedana, gives the following account of his three-year-old grape-vines:

My vines are of the Muscat variety, and three years from cuttings, and without irrigation from the setting. Former care of the same has not been with the view of raisin-making; hence it is safe to assert that they have lacked the proper attention in some respects that would have been to their advantage. But such as it has been, am now enabled to present the following as the returns for the crop just marketed:

Gross receipts from raisins, per acre, $61.76; from grapes, per acre, $13; from cuttings, $13.98; total, $88.74. Deducting the sum of $25 per acre for the entire expense of care of vineyard and marketing crop, which includes everything connected with the work, and we have a profit of $63.74

MODE OF MAKING RAISINS IN SPAIN.

As Spanish raisins are of high repute, and all information on this subject desirable in America, I extract from a paper by W. B. West, making it a part of my report:

Only a few years ago it was impossible to find any California raisins that were worthy of the name. We were groping in the dark; we knew nothing of the varieties to plant, how to cure them, or how to pack them. We knew nothing of localities suited to the raisin grape, and we had extravagant notions of the profits of the business.

We begin to understand the requirements of the business. We have also learned that to succeed we must have knowledge, patience, energy, and brains; that we must have the right kind of soil and climate for the true raisin grape. The Muscatella will not succeed everywhere, even in California. Many who rushed into the making of raisins a few years ago found that there was too much to learn, and gave it up after making a few tons of trash from all kinds of grapes, dried and packed in a slovenly manner. A few indomitable persons stuck to it; they had hard times; the price of foreign fruit was low; they had much to learn; but they persevered and are now nobly rewarded. They have taught us that only in certain localities can the business be carried on profitably. We are gaining information by these experiments every day, so that the future of raisin culture is more certain.

I believe in the future this business is destined to be carried on by small farmers. It is pre-eminently a matter of detail. It is such a business as will give employment to the family of the poor man—the one to make the little homestead in the hills a source of revenue. To these the Spanish method is well adapted. I propose, therefore, in this paper, to give their methods of cultivation and preparation for market. From a people who have cultivated the grape and made raisins for many generations we can certainly learn something, especially as we are only beginners.

THE SPANISH METHOD OF CURING.

In their mode of curing we may find something of advantage. As our grapes ripen nearly a month later than theirs, we have trouble to get them dried, and have resorted to many expensive methods to accomplish this purpose.

The climate in which the Spaniard cures his raisins in fifteen days is not any warmer than ours. It is a little more moist, and sometimes varied by showers; but his fruit being securely covered by boards remains perfectly safe, and by being covered at night to protect it from the dew, he is enabled to cure his raisins in the time stated, while we in California, who cure them on boards or canvas, are usually twice as long. Their grapes commence to ripen by the 1st of August and are usually gathered by the 15th of that month. They are not all picked at the same time; only those that are perfectly ripe. Much judgment is required in this matter, as unless the grapes are perfectly ripe they will not make good raisins. They are picked from the vines very carefully, taking care to handle them by the stems, and are placed upon willow trays and carried to the drying-floors. In every subsequent operation care is taken not to disturb the bloom, which is very important to the higher grades.

The drying-floors are constructed as follows: Where the country is a little hilly, as it usually is, advantage is taken of some slope with a southwestern aspect. When this is not attainable, an artificial slope is sometimes made by building a strong wall for the back and sides and filling in with dirt. Sometimes they are perfectly level. They like to have them with such an inclination as will allow the water to run freely from the covers. The length of these floors, which depends upon the inclination of the land, is usually about 45 feet where the angle is about 45°; where it is steeper they can be longer. The width is 14 feet. Between each bed is a path of 3 or more feet. Around the outside of these beds is a row of tile to prevent the water from entering from the paths. These are properly cemented, and it is very important that no water should enter. In the middle is a row of tile to support the center of the covering, which is of boards 14 feet long by 1 foot wide. They are laid across the bed, and are lapped one over another, so that no rain can get in. The bottom, upon which the grapes are placed, is of the natural soil, and is always loose and dusty, the vineyardists contending that the dust rather protects than disturbs the bloom. Th grapes are placed quite closely upon this floor, but not so as to cover each other. Every one who has grown grapes knows that there is one side of a bunch of grapes that shows the stem more than the other. This side should be placed upward. The covers should not be placed on at night, until the grapes have shriveled a little, or in three or four days. At the end of eight days, if the weather is good, they will require to be looked over, to take out such grapes as have dried in advance of the others, and these are clipped out with a pair of scissors. If allowed to remain they would become hard and worthless. A man commences at one end of the bed and selects those that are dry, or nearly so, placing the remainder back just as they were before, not turning them over, as is the universal practice here. The reason for this is that the side cured on the ground presents a more attractive appearance than the other.

At the end of the next seven days the raisins are fully cured. Here let me state that no substance has been found that will cure a raisin so well as the ground, and no plan have I ever seen that seemed to me to be more fitted to accomplish the object sought than the Spanish hill-side drying-floors.

Those made upon level ground require a few days more to cure the fruit, and are sometimes covered with cloth or corrugated iron. The superiority of this method over the ordinary California way of using boards or canvas is so marked that I hope some of our vineyardists will give it a trial. The necessity of covering fruit at night is not properly recognized in this State. I have found fruit in Spain warm and dry in the morning, whereas it would require at least two hours' sun to bring it to that state had it not been covered. The covers also protect them from any showers that might come up during the dry season. They are also useful in retarding the drying, as it sometimes occurs that the raisins cannot be packed as fast as they dry.

ASSORTING AND PACKING.

The raisins are taken directly to the packing-house, and assorted and packed immediately for market, not going through any sweating process. This sorting is of such a complicated nature, and requires so much skill, that it would be utterly impossible for us to follow it. They calculate that it requires a day's labor to select and pack a box of the best raisins. Another good reason is that the American market demands but few of the higher grades of fruit. The London layers and the loose Muscatells are the most sought.

The fruit is taken immediately to the place for assorting. A skillful workman takes each bunch in succession and grades them according to their size and condition. When a bunch contains two or more grades, as they usually do, it is cut up so that each can be put in its proper place. Each kind is carried to the workman who is packing that particular class. Although the raisins never hold out to the weight which they are supposed to represent, I noticed the workmen were careful to weigh each form as they were put in the box. They are packed in forms of six pounds each, using common paper, which is replaced in the warehouses by a more fancy article, at the option of the purchaser. The loose Muscatellas are those single berries which may be on a bunch of superior class, which their strict grading requires to be cut out; hence they are usually of a better size than their price would seem to warrant.

Mr. West further said, in relation to the raisin industry in California, what others who are engaged in it also informed me, that objections to or faults hitherto found with California raisins grew out of the fact principally that there was not care enough exercised in making them. They were made of all kinds of grapes that would dry. They were not evenly cured; not uniform in size, and too small. The latter was caused by permitting vines to overbear.

There is a future for the raisin industry in the United States, when we remember the demand for them, to supply which not less than 3,000,000 boxes are annually brought to us from foreign lands. It is demonstrated that California possesses all the essentials to supply at least all our home demand. I have given results from four different and distant portions of the State.

ORCHARD AND SMALL FRUITS.

LOCAL AND CLIMATIC ADAPTATION OF FRUITS.

The commission was able only to visit personally representative regions. Dr. J. Strentzel, chairman of a committee appointed by the State Horticultural Society to condense all valuable information relating to adaptation of fruits to different parts of the State, has brought the whole matter into such concise and comprehensive shape that it is adopted as part of this report, adding, in so doing, that personal observations, where made, suggest no change of the statements made by the doctor. His condensation is based on one hundred and fifty reliable and carefully prepared reports, some from each county in the State. He says:

> To systematize these reports, adapting them to general view, it seemed most suitable to group contiguous counties subject to nearly the same climatic and topographical conditions, although it should be understood that, owing to manifold configurations of the land, alluvial or detrital soil, &c., an extreme variation exists in its productive quality, even on comparatively limited parcels of ground, so no rigid rules what to plant can be prescribed or made applicable to large bodies of land without closely discriminating the surrounding local conditions. Thus, for instance, in the central counties located around the bay, eminently adapted for the culture of the choicest fruits, some of the terrain is adapted to the growth of apples; peaches will not do so well, and *vice versa*. Some produce apricots and almonds to perfection where figs are nearly a failure. So we are restricted to noticing in each county as reported the predominant feature in fruit raising, following with a list of fruits of acknowledged excellence, adapted for export, for the use of desiccators and canning establishments, to secure permanent support to families distributed over small tracts of land, to multiply our resources, to prevent that rapid deterioration and exhaustion of the soil consequent upon the skimming process of grain production, to increase the esthetic taste of the people for the beautiful, and draw a rich usufruct from land heretofore producing at best a scanty pasturage.
>
> ### CENTRAL BAY COUNTIES.
>
> *Alameda.*—The land along the San Lorenzo Creek is unsurpassed for small fruits, the currant leading; good plums, prunes, apricots, apples, pears, and almonds; rather too cool for the fig; peaches suffer with curl-leaf; olives grow well; crops are grown with irrigation.
>
> *Contra Costa.*—Good for choice apples, pears, plums, prunes, cherries, figs, pomegranates, quinces; sheltered nooks for oranges. higher land for apricots and almonds; southwesterly slopes of the valleys are choice peach land; all the country around and at the foot of Mount Diablo is destined to be a continuous orchard; crops grown without irrigation.
>
> *Santa Clara.*—Apples, pears, plums, cherries, and small fruits do well; peaches, apricots, and figs on high, sheltered land; olives produce well; curl-leaf and mildew very prevalent and injurious; irrigation partial.
>
> *San Mateo.*—Apples, pears, plums, prunes, cherries, olives, and figs do well; peaches curl badly, scale bugs and aphis prevailing; fruit ripens one month later than in Santa Clara.
>
> *Santa Cruz.*—Excellent for small fruits and berries, apples, pears, and plums; figs and cherries a failure; some mildew on pears, curl-leaf on peaches, coddling moth, woolly aphis, caterpillars damaging fruit; too much water in the ground, but the mountain above the fog-line is proven as choice land for the raising of all fruits of the temperate region.
>
> *Solano.*—Around Vacaville and Green Valley fruit ripens earlier than in the adjoining counties; apricots, peaches, and figs do best, and are most profitable to raise; apples, pears, plums, and prunes do well; too hot for currants, raspberries, and walnuts; almonds not a sure crop; no irrigation.
>
> *Napa.*—Apples, plums, prunes, pears, and quinces very productive; apricots, cherries, figs, almonds, and peaches require well-sheltered, warm spots; curl-leaf and mildew destructive to peaches; no irrigation.
>
> *Sonoma.*—Apples, pears, plums, and prunes do exceedingly well; cherries, fair; walnuts and almonds, uncertain; apricots get frosted; peaches destroyed by curl-leaf and mildew; small fruits do well; no irrigation.
>
> *Lake.*—Apples, pears, and plums very good; apricots, almonds, figs, and peaches require choice locations; cherries do not do well; no irrigation.
>
> *Yolo.*—Apples unprofitable; pears and plums do well; few peaches raised, which suffer with curl-leaf and mildew; almonds and cherries uncertain; figs and olives do well; oranges frosted; practice irrigation.
>
> ### NORTHERN TIER OF COUNTIES.
>
> *Mendocino.*—Apples, pears, and plums do well; too frosty for peaches and figs.
>
> *Humboldt.*—Apples, pears, and plums; berries do well; no semi-tropicals.
>
> *Del Norte.*—Similar to Humboldt.
>
> *Shasta.*—Apples, pears, plums, and almonds do fairly; walnuts very well.
>
> *Siskiyou.*—Apples, pears, and plums do well; peach apricots often frosted; May Duke and Oxheart cherries succeed well.

INLAND COUNTIES.

Colusa.—Apples, pears, plums, prunes, peaches, and figs do well; seedling oranges [illegible].

Tehama.—Apples and pears good; figs and peaches extra good.

Plumas.—Apples and pears good; too frosty for peaches; irrigate.

Butte.—Apples, pears, plums, and figs good; peaches injured by curl-leaf; almonds, walnuts, oranges, and cherries do not do well.

Yuba.—Apples, pears, plums, and peaches do well; almonds and apricots unproductive; figs do not ripen well.

Nevada.—Apples, pears, peaches, and plums do well; apricots, almonds, walnuts, olives, and figs get frosted; chestnuts are splendid.

Placer.—Apples, pears, plums, olives, and figs do well; peaches curl and mildew; high ground preferred for orchard; irrigate.

El Dorado.—Apples, pears, plums, and peaches do well; apricot trees killed to the ground; irrigate.

Amador.—Apples, pears, peaches, and plums; soft-shell almonds, oranges, olives, pomegranates, and figs do well, subject to curl, codling moth, and untimely frost.

RIVER COUNTIES.

Sacramento.—Apples, pears, plums, prunes, peaches, and apricots do well; of small fruits, blackberries exuberant; figs, A No. 1; almonds do well; irrigate upland; codling moth abundant.

San Joaquin.—Too warm for apples; pears do well; plums and prunes extra good; peaches subject to curl and mildew; apricots uncertain; almonds not reliable; cherries not favored; olives and figs do well; oranges frosted; sandy land requires irrigation.

Stanislaus.—Apples to be of any account must be irrigated; pears do better; peaches curl, but bear well; plums a failure: apricots very successful; cherries not good; irrigate.

Tuolumne.—Apples, pears, and plums do very well; peaches curl badly; apricots and cherries do well; almonds not reliable; figs excellent; oranges frosted; irrigate.

Merced.—Apples poor and wormy; peaches curl badly; plums, apricots, pears, and figs do well; cherries do no good.

Fresno.—Apples and pears do well; peaches, apricots, and prunes grow to perfection; almonds not reliable; too wa m for figs; walnuts and oranges get frosted; irrigation indispensable.

Tulare.—Apples, pears, apricots, peaches, and almonds do well; walnuts not successful; oranges frosted; cherries not good; young fig trees frosted; codling moth and aphides plentiful.

SOUTHERN COUNTIES.

Monterey.—Few apples and pears are raised; peaches curl badly; apricots and figs do well; almonds a failre; also cherries; too cold for oranges.

San Benito.—Apples, pears, plums, prunes, cherries, almonds, and figs do well; walnuts unsatisfactory; in some localities peaches destroyed by curled leaf.

San Luis Obispo.—Apples do well; pears, prunes, peaches, apricots and figs, tolerably well; all fruit does well in sheltered localities, out of the frost belt, without irrigation; oranges moderately good.

Santa Barbara.—Apples pears, few raised; young trees doing well; apricots, peaches, plums, walnuts, figs, and olives grow well; almonds not satisfactory; cherries do moderately well; oranges suffering from black smut and scales; curled leaf and insects annoying.

[NOTE.—No report was received from Ventura County. It is, however, well known that the valley of the Santa Clara River is an excellent fruit region, more especially for walnuts, chestnuts, almonds, and figs. Extensive orange and lemon orchards, also, have been planted near Santa Paula. Other valleys of the county, such as Ojai, are similar in character.—E. W. H.]

Los Angeles.—Apples, pears, and plums on clayey soil do well; cherries, almonds, and walnuts unsatisfactory; apricots and figs very good; oranges get frosted in some places, but attain great perfection, are of large size, and excellent flavor; irrigation required.

San Bernardino.—Apples, plums, cherries, almonds, do not thrive; apricots, olives, [illegible]lnuts, and oranges do well; peaches curl, but on high and warm lands they oranges and raisins the prevailing culture; irrigate.

go.—Apples perfect success; peaches do well; plums and almonds a failure; nd oranges a success; irrigate.

DEDUCTIONS.

Apples require a cool location and richest of soil to produce fruit of full size and good flavor—low standard. Dusting the trees with a compound of ashes and lime during the rainy season is efficient in destroying insects, pests, and fungoid growths; by keeping the ground around the trees scraped smooth, with a cone of lime and ashes around the stem, codling larvæ will be deprived of shelter.

Pears.—Succeed almost everywhere in California, and respond most readily to the richest of soil; neither much injured by alkali nor swampy soil.

Quince.—There is a broad field to gain notoriety and rich reward by the production of a new superior seedling quince, free from black knot.

Peaches.—Most of the old white varieties are suffering with curled leaf and mildew; at their worst during cold and wet springs, when the excess of sap is not duly elaborated, for lack of solar heat, provide a ready food for the fungoid growth. No persistent efforts, so far as known, have been made to destroy it, although, judging from analogy, sulphur promises to do the service, in which it proves so efficient on the grape mildew. To infuse new vigor to the stock debilitated by the use of seed from budded trees, the sweet, hard-shell almond offers a substitute to bud the peach upon. Peaches to do well require a warm, sheltered ground, the richest of soil, and regular shortening in the process of pruning and thinning out the fruit.

Apricots.—The almost unlimited demand for the fruit and consequent great value of a productive apricot orchard suggest close attention to the requirements of the tree and shelter from spring frosts; an experience has to guide us in the selection of a location. A rising ground facing west is most eligible, although flats, near large bodies of water, appear to furnish the same exemption. The use of apricot and plum seedlings for stock to bud the apricot upon is nearly discarded, and peach preferred. The yellow varieties of more stocky growth should be used. The practice of rebudding old almond trees, if successful, may bring almond seedlings in demand.

Almonds.—The responses show the production to be limited, owing to late frosts; requiring close observation to conditions favorable to abundant fruiting, as the trees are very thrifty and the nuts valuable.

Plums and prunes for canning and drying are in great request, causing a corresponding demand for trees, not fully supplied, owing to scarcity of non-suckering plum stocks, which started the practice of budding the plum on peach seedlings, some plums requiring double working to secure well-jointed trees. The inadequate supply of our nursery-men will induce some to import trees from eastern sources, and with them the dreaded curculio may be introduced. To avoid this calamity strenuous efforts should be made by the chief executive horticultural officer to provide an efficient quarantine and disinfection of such imported trees.

Cherries.—The superabundance of the Black Tartarian will require many trees to be regrafted with Royal Ann and other light-colored varieties; the reponses disclose the fact of the limited area within which this fruit can be grown in perfection; the insect pest noticed last spring in some orchards should be closely investigated during the ensuing year.

Citrus fruits.—The experience of late years narrows the profitable culture of the orange to four counties as now constituted, still of sufficient extent to produce oranges, lemons, and limes to supply all the domestic demand for said fruits and spare some for foreign export. The industry and sagacity of our people will brush off the scale and clean the golden fruit of its black incubus.

Figs.—Figs grow with but little trouble or care, and yield abundantly, and of most excellent quality in the greater part of the State. For some reason but little attention comparatively has been given to this fruit. Those who have manipulated them are quite well satisfied with results, and it is believed the time is in the near future when figs will be an important factor in fruit culture in California. The mode of preparing is simple, and the price fair. They are dried for a short time in the shade, then scalded, then fully dried, pressed, and packed in boxes. Thus prepared they will keep soft and fresh for a year or more. Good pressed figs are worth in the San Francisco market about 6½ cents per pound.

The *pomegranate* bears fruit abundantly, from the warmer valleys of San Francisco Bay to San Diego.

Small fruits.—With water and compost at command, one acre of land can be made to produce sufficient income for the sustenance of a moderately sized family planting strawberries, currants, raspberries, blackberries, &c. Strawberries are to be found in the San Francisco market during ten months in the year.

The above statement regarding citrus fruits hardly does justice to the demonstrated possibilities of the production of oranges, at least, northward of the Los Angeles region. The orange has ripened well, and with the best qualities of the fruit as far north as Marysville, and excellent fruit comes into market in small lots from several of the valleys of the Coast Range north of San Francisco. Singularly enough, such fruit is usually several weeks in advance of the oranges of Southern California; doubtless in consequence of the more intense heat of these valleys in summer as compared with the coast climates of the South. The same is true of other fruits, the cherries of Vacaville, in Solano County, for example, being nearly a month ahead of those of Santa Barbara, and the earliest in the entire State. Excellent oranges are grown within two miles of Martinez, Contra Costa County, about 15 miles east of north from San Francisco, in a sheltered valley of the Coast Range.

For the success of the citrus fruits in the more northerly region it seems absolutely essential that the trees should have been grown, at least from the graft, in the same climate. They thus become so hardy as to be injured only by extremely severe weather; at the same time, their growth is considerably slower, and of course the period before coming into bearing longer. Trees imported from Los Angeles to the Bay region are so tender as to be set back severely by frosting, if not actually killed, and thus are eventually longer in yielding fruit than those of northern growth. Orange culture in the San Joaquin Valley has hardly been fairly tested as yet, but there can be little doubt that it will be successful when properly managed.

Much has yet to be learned as regards the proper management of citrus fruits in respect to irrigation. As is usual, when the use of water has been secured in an arid country, irrigation has often been carried to excess, to the injury of the quality of the fruit, and often greatly to the detriment of the health of the trees. It seems pretty well established now that the minimum amount of irrigation compatible with full development secures the highest quality of fruit and the best health of the tree; but the exact measure of this amount is still the subject of much discussion among the growers, and must evidently be determined separately for each location and soil.

It has been strongly insisted upon that the number of citrus trees already planted in California at this time is all that the market will carry, when they get into bearing. But it is difficult to predict what will be the changes wrought within that time by the establishment of new routes of communication, and therefore new markets.

The orange crop, being saleable only in the fresh state, is most easily overdone. That of lemons and limes, being available for the manufacture of citric acid and essences, will not easily be in excess of what may be utilized. So far, scarcely an attempt has been made to dispose of the inferior qualities or surplus in this way; nor has there been any attempt to manufacture the essences of the flowers, whose sweetness has thus far been wasting on the desert air.

The growers of citrus fruits will find, as they come more fully into competition with each other and with the rest of the world, that these minor industries connected with their product will oftentimes form the turning-point of the beam as regards profit and loss, and that they cannot afford to neglect them much longer. Miles upon miles of hedges of limes now annually waste their fruit on the ground for want of a market for the fresh fruit; lime juice has been made on a small scale, but was driven or kept out of the market by the article imported from Tahiti. All this will correct itself in time, but it is quite essential that the attention of those engaged in the culture should now be drawn to the dormant possibilities of their industry.

As to the quality of California fruits, they will doubtless be able to compete with any in the market, so soon as proper care is bestowed upon sorting and packing. It has been too much the habit of growers to ship promiscuous lots, large and small, sour and sweet—a practice of which disadvantages are too obvious to require comment. It is only quite lately that wrapping choice fruit has been begun in California; and it is very emphatically stated that it does pay.

The subjoined analyses of some California citrus fruits may serve as a basis for comparison with those produced in Louisiana and Florida, whenever data for the latter may become available.

ANALYSES OF ORANGES.

At the request of the South California Horticultural Society, through its secretary, Mr. L. M. Holt, the following analyses of oranges grown in 1879 were made for the purpose of obtaining data for comparison with the fruit of other countries. One specimen, a Mediterranean Sweet, grown by Mr. J. M. Asher, of San Diego, was somewhat under size, but with a very fine, smooth skin and high flavor. The other was a large and fine-looking fruit somewhat rough-skinned, but in flavor and sweetness very nearly the equal of the other, a seedling grown by Anson Van Leuven, of Old San Bernardino.

In the statement given below, the third column shows the data of the analysis of a Florida orange, variety not stated, made by Dr. J. R. Nichols, of Boston, and published in the Jackonsville (Fla.) Sun and Press; also in the Southern California Horticulturist for April 1879.

Constituents, &c.	Mediterranean sweet.	Van Leuven seedling.	Florida orange.
Total weights of fruit.....grams..	149.7	233.5	246.5
	Per cent.	*Per cent.*	*Per cent.*
Skin	10.487	28.738	23.[illegible]
Seeds	.341	.700	2.64
Pulp	89.172	70.55	73.[illegible]
The skin contained:			
Water	43.723	77.6169	78.00
Volatile oil	5.753	1.6775	21.36
Organic matter	49.505	19.812	.64
Ash	2.019	.8936	....
Seeds contained:			
Water	55.630	53.09	50.00
Organic matter	42.941	45.32	48.64
Ash	1.429	1.59	1.36
Pulp contained:			
Water	86.446	86.982	90.[illegible]
Organic matter	13.121	12.572	8.06
Ash	.433	.446	.33
Sugars:			
Saccharose	7.57	7.33	3.3
Levulose	2.91	2.9	3.[illegible]
Total sugars	10.48	10.24	....
Acid:			
Citric acid	1.43	1.284	1.00

About 30 grams equal one ounce avoirdupois.

The most striking point in the above comparisons is the fact that while in the California oranges the total amount of sugars is over 10 per cent., in the Florida orange it is only about 6½ per cent. This, of course, cannot be taken as a general truth until corroborated by still farther examinations of definitely-named varieties of Florida oranges. Moreover, the statement made by Doctor Nichols that *grape sugar* accompanies the cane sugar in the orange must, on the whole, be deemed improbable, unless confirmed by direct tests. The optical tests in the California oranges indicated altogether the presence of fruit sugar, or levulose, instead of grape sugar. The acid percentage seems to be smaller in the Florida orange in the same proportion as the sugar. As between the two kinds of California oranges the most striking differences are in proportion between the skin and pulp—a matter of the most vital interest to the consumer. The thin-skinned orange has nearly 19 per cent. more pulp than the thick-skinned variety, the difference being mainly due to the large amount of water contained in the skin of the latter, which is at the same time much poorer in volatile oil. In the quality of the pulp, however, there is little difference, so far as analysis can determine this point.

In March, 1880, six samples of oranges were forwarded by the executive committee of the Riverside Citrus Exhibition, with request for analysis. The subjoined table exhibits the results obtained, so far as the scanty supply of material would permit. It should be understood that for some of the determinations as many as four of the smaller oranges are indispensable.

The analyses of several other kinds are given in Nos. 7, 8, and 9.

No. 1 (2 oranges).	Naval orange (premium).
No. 2 (2 oranges).	Seedling (premium), Garcelon.
No. 3 (2 oranges).	Kona, Garcelon.
No. 4 (2 oranges).	Saint Michael's, Garcelon.
No. 5 (2 oranges).	Seedling, T. J. Wood.
No. 6 (2 oranges).	Bergamot, Garcelon.

No. 7. Mandarin orange, sent by Mr. A. B. Chapman, Los Angeles, received February 10, 1880.

No. 8. Japan oranges, presented by Mr. E. V. Cowell. They were considerably dried up when analyzed, and in spots somewhat decayed.

No. 9. Wolfskill's "XX lemon," grown by J. W. Wolfskill, Los Angeles, received March 15, 1880.

Number.	Total weight.	Pulp.	Skin.	Specific gravity of juice.	Amount of solid matter.	Acid.	Sugars. Cane.	Sugars. Levulose.
	Grams.	*Per ct.*	*Per ct.*		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	228.5 234.7	78.44 78.46	21.56 21.54	1.047	11.57	0.749	3.95	1.62
2	... 197.7	...... 66.42	...... 33.58	1.050	21.28	0.767	5.78	1.935
3	223.0 185.1	70.05 73.21	29.05 26.79	1.049	12.05	0.998	4.43	1.308
4	143.0 133.3	81.82 80.72	18.18 19.28	....	....	1.305	5.04	1.655
5	192.8 165.5	75.52 65.44	24.48 34.56	....	....	1.919	5.01	1.505
6	85.5 88.5	66.32 66.68	33.68 33.32	....	....	4.365		
7	141.3	74.05	25.05		....	0.920	6.01	1.34
8 a	108.6	....	....	....	....	0.691	7.24	2.14
8 b	......	....	....	....	....			
8 c	59.4	88.07	11.03	....	....			
9	133.6	88.97	11.03	....	....	7.31		

The extraordinary amount of acid in No. 6 creates a suspicion that it was not fully ripe, but the material was insufficient for a sugar determination. The acid percentage of the Wolfskill "XX" lemon is above the usual average.

ACID TESTS OF LEMONS.

In March, 1879, a request was received from the South California Horticultural Society for the communication of some method by which the acid strength of lemons and oranges could be determined, without too much of the chemist's appliances, by the committee on the subject, appointed on the occasion of the Citrus Family Fair held at Riverside at that time.

In response to this request a quantity of a carefully "standardized" solution of caustic potash was forwarded to the society, with directions for use; and the tests were carried out successfully by the committee, consisting of Dr. O. H. Congar, of Pasadena, and Mr. C. F. Heinzeman, druggist and chemist, of Los Angeles. The results obtained by them, originally published in the South California Horticulturist, for April, 1879, are here appended in a tabular form. It is to be regretted that the weights of the respective samples of lemons are not given, but this omission will doubtless be made good in the tests to be made the coming season.

The calculations are made on the assumption that all the acid of the lemon is citric acid, which, of course, is not rigorously true, as some malic acid is probably always present. Since, however, for most of the uses of the lemon there is no difference in the value of the two acids, the tests are strictly correct for comparison.

No.	Name.	Amount of juice.	Per cent. of citric acid.	Amount of citric acid in lemon.
		Grams.		*Grams.*
1	Thorb's seedling, budded on orange stock	9	6.4	.58
3	Lisbon lemon, on lemon stock	10	7.0	.7
7	Lisbon lemon, on lemon stock (very large)	12	9.8	1.18
8	Lisbon lemon, on China lemon stock	10	7.13	.713
9	Eureka lemon from original tree	8.5	7.3	.62
11	Seedling lemon, the "Olivia"	5	8.8	.44
15	Eureka lemon, on orange stock	3	9.6	.29
17	Australian lemon, on orange stock	5	7.8	.39
20	Seedling, the "Riverside Knobby"	6.5	10.0	.65
23	Thornless sweet-rind, on orange stock	3	6.0	.18
35	Eureka orange, on orange stock	7	7.13	.5
36	Lisbon lemon, on orange stock	9	7.5	.68

EXAMPLES OF FRUIT PRODUCTION.

As illustrative, a few statistics are given as obtained in person relating to fruit-growing:

J. W. WOLFSKILL, *Los Angeles.*

This is the oldest orange grove or orchard in California—110 acres. A portion of these trees were planted in 1841. Some I measured; body, 2 feet from ground, 3 feet 9 inches in circumference; 30 feet high. Trees planted 24 to 28 feet apart. Seedling trees commence bearing at seven to ten years old; budded ones at from three to four years. A ten-year-old tree will produce 500 oranges; at twenty years, from 2,000 to 3,000 each. Ground is kept clear, irrigated, and stirred often; almost constantly when not irrigating. Irrigates about six times in a year, by submerging ground between rows, in older orchards; in younger, immediately about the trees. Two hands will irrigate 6 acres a day. Cost of water, $2 per day. This is far below the average cost of irrigation when water is purchased. In this immediate locality water is abundant and cheap. Freight: Los Angeles to Chicago, by rail, express, six to seven days, $1,000 per car; two to three weeks, $500. Three hundred boxes a car load; 150 oranges to the box, average size. Orchard principally seedlings. Is introducing, with success, improved foreign varieties. Few insect ills.

Since the official visit of the writer to Mr. Wolfskill's grounds, where he obtained the data given, the general superintendent of the Southern Pacific Railroad has given the fruit interests in the Los Angeles region more favorable transportation rates for January 1, 1882. For oranges, from Los Angeles to San Francisco in car lots, $10 per ton. From Los Angeles to Kansas City, $300 per car load of ten tons; Saint Louis, $335; Chicago, $350.

E. J. BALDWIN, *Rancho Santa, Anita, Los Angeles County.*

	Acres
Oranges	25
emons	1
lish walnuts	6

	Acres.
Almonds	30
Peaches	40
Plums	10
Miscellaneous fruits	20

Principally young trees, just commenced bearing. Almonds have not given satisfaction.

For Los Angeles County, I found complete record as to the status of fruit-growing, showing:

Orange trees		192,000
Lemon trees		30,250
Olive trees		3,000
Apple trees		20,500
Pear trees		13,345
Fig trees		7,325
Plum trees		3,125
Peach trees		24,375
Quince trees		1,900
Grapes	acres	6,225
Miles irrigating ditch		345
Acres land irrigated		52,515

THOS. W. COVER, *Riverside.*

This gentleman has 10 acres good bearing limes, which yielded as high at 100,000 limes in a week, the value of which, at the orchard, was $1,500.

California apricots stand high in the market as a canning fruit. Where they flourish, every one who can is planting. Such was the demand for trees this fall that about all stock of nurseries was exhausted. They bear early and yield well. Mr. George Crawford, Riverside, showed 1,200 trees, four years old, which yielded this season 11 tons fruit; sold for $55 per ton. While the price realized is not up to the market, the income of a four-year-old orchard is thought worthy of notice.

Mr. Caldwell, near Petaluma, gives his experience and suggestion as to plum culture:

> I have tested many varieties, observed the peculiarities of soil necessary for their growth, and the kind of stock to be used. The best kinds for pitting are the Columbia Gross prune and Washington; for prunes the Petite Prune de Agen, and the Yellow Egg for canning.
>
> Almost any of our soils are good for growing prunes, but a clay subsoil is best. Twenty-five acres in plums will make a man a nice income in a few years. I have in my orchard two acres and a half in plums, and they pay me on an average $500 a year.
>
> If you set out two-year old trees, they will pay expenses the second year, and the third year you can realize a profit of $50 an acre. Say, as an illustration, 100 trees to the acre, 25 pounds to the tree will yield 2,500 pounds of green fruit, which will make 500 pounds of pitted dried fruit, worth at 10 cents per pound $50, which is a nice income on the investment. Of course, as the trees grow older the crop will become larger and more profitable. I candidly believe that the above-named quantity of land in plums will, one year after another, pay a greater profit than the best 300-acre grain farm in the county.

General JOHN BIDWELL, *Rancho Chico, Chico.*

General Bidwell has 1,000 acres bearing orchard—apples, peaches, plums, pears, apricots, blackberries, cherries, and almonds.

This season 15 tons green apples, bringing from ¾ to 1½ cents per pound; 5 tons dried, 5 to 6 cents per pound. Pears, green, 5 tons, 2 to 3 cents per pound; dried, one ton, 8 to 9 cents per pound. Apricots, green, 5 tons, 2 to 3 cents per pound; dried, 1,000 pounds, 14 to 15 cents per pound. Peaches, 60 tons, green, 1 to 2 cents per pound; dried, 50 tons, 10 to 13 cents per pound. Plums, 60 tons, green, 1½ to 2 cents per pound; dried, 16 tons, 11 to 13 cents per pound. Grapes, green, 15 tons, 3½ to 5 cents per pound; dried, 10 tons, 5½ cents per pound; 10 tons of raisins, 10 to 12½ cents per pound. Blackberries, green, 20 tons, 3 cents per pound. Almonds, 30 tons, 12 to 14 cents per pound. Also 50 fig, twenty-five each quince and olive, of which no account was taken.

MRS. JEANNE C. CARR, *Pasadena.*

Mrs. Carr has planted 42 acres. Ground broken and first planting done 1877. Fourteen thousand grapes, principally raisin varieties, with an experimental vineyard of seventy-two varieties.

Non-irrigation thoroughly tested by watering ends of rows containing twenty-eight vines each, 8 feet apart; leaves the opposite end without water. Seven hundred orange trees, one hundred and fifty lemons, one hundred limes, irrigated between May and September. Three hundred apples, five hundred peaches, fifty each plums, nectarines, pears, and figs. Two hundred English walnuts, one hundred prunes, two hundred pomegranates, twenty to twenty-five each almonds, white walnuts, pecans, chestnuts, olives, cherries, guavas, jujubes, and Japan persimmons. Also, berberries, raspberries, and strawberries of many varieties. Several choice varieties mulberry for silk culture. Seventy species American forest trees along drives. Not more than one-half of all these have been irrigated since first year of planting.

In 1880 600 pounds of raisins made from vines planted 1878 and 1879. Sold 1,200 pounds apricots from trees planted 1878. Dried 800 pounds prunes and peaches, and sent to market large quantities of other orchard products, of which no account was kept.

Thirty varieties forage plants have been grown successfully in this small tract. Some with and others without irrigation. With slight protection, bananas grow in this locality. Altitude, 1,200 feet.

SPECIAL REPORT REGARDING OLIVE INDUSTRY.

Olive culture has already become an important factor in the fruit industry of California. It succeeds in almost every part of the State, especially along the coast, south of San Francisco, and in Southern California.

Ellwood Cooper, of Santa Barbara, has, perhaps, given this industry more attention, with a view to thoroughly utilizing it, than any other person. From him the data here presented are obtained:

> The common and preferred method is to plant the cuttings, taken from growing trees of sound wood, from three quarters of an inch in diameter to 1¼ inches, and from 14 to 16 inches long. These cuttings should be taken from the trees during the months of December and January, neatly trimmed without bruising, and carefully trenched in loose, sandy soil. A shady place preferred. They should be planted in permanent sites from February 20 to March 20, depending upon the season. The ground should be well prepared and sufficiently dry, so that there is no mud, and the weather warm. In Santa Barbara, near the coast, no irrigation is necessary; but very frequent stirring of the top soil with a hoe, or iron rake, for a considerable distance around the cuttings, is necessary during the spring and summer. About three-fourths of all that are well planted will grow. My plan is to set them 20 feet apart each way, and place them in the ground butt-end down, and at an angle of about 45°, the top to the north, barely covered. Mark the place with a stake. By planting them obliquely, the bottom end will be from 10 inches to 1 foot below the surface.

All trees, as a rule, should be propagated from seeds. The roots are more symmetrical, the tree not so liable to be blown over, and the growth more healthful; but I have not been successful in germinating them, hence I recommend the cutting. If the trees are propagated from seeds, budding or grafting is necessary.

FRUIT BEARING.

Trees grown from cuttings will produce fruit the fourth year, and sometimes, under the most favorable circumstances, will give a few berries the third year. It is the habit of the tree to overbear, and as a consequence it will give but little fruit the year following a heavy crop. This statement is verified by the most reliable books published on the subject in the French, Italian, and Spanish languages. There are, however, exceptions to this rule in California. Mr. Davis, who had charge of the San Diego Mission orchard, in 1875, assured me that he gathered from the same tree, two years in succession, over 150 gallons of berries. I have also observed that some trees in my orchards have borne well in successive years. The fruit bearing can be controlled by the pruning. The cultivator will not forget that the shoots or branches must be two years old before they will give fruit, hence partial pruning every year will give partial crops. My oldest orchard was planted February 21, 1872. At four years I gathered from some of the trees over two gallons of berries; in 1878, over 30 gallons each off a few of the best trees, the orchard then being only six years old. In 1879, the seventh year, the crop was not nearly so large. I had planted several thousand cuttings in the spring of 1873, but these trees did not give, at six years, a result equal to the first planting. The present crop is quite good, the oldest orchard now being eight years, and I think I do not overestimate when I state that the yield of some of the best and fullest trees will be over 40 gallons. Trees large enough to give this quantity of fruit, planted at a distance of 20 feet, will occupy nearly all the ground, and therefore give all the fruit that can be produced on one acre.

An orchard bearing uniformly the quantity as above, would give the following result: One hundred trees to the acre, at 40 gallons each, 4,000 gallons. This would be an enormous crop, unprecedented, and far beyond any statistics given in European publications. The one-fourth of the quantity yearly would be a very profitable crop.

In estimating an orchard, the yield of isolated trees, or trees of great age, occupying considerable areas of ground, must not enter into the basis of calculation of the probable production.

The tree mentioned in the San Diego Mission orchard as yielding 150 gallons of berries was more than 50 feet distant from those surrounding it.

French cultivators give the quantity of oil contained in a given quantity of fruit as one-eighth, and in weight, one-tenth; that is 8 gallons of berries to 1 gallon of oil, and about 50 pounds of berries to 1 gallon of oil.

Olive trees grown from seeds are not removed from the nursery until about seven years old; grown from cuttings, they bear in Europe as early as they do in California.

The newness and richness of our soil will probably give, the first fifty years, double the best results given in those countries where oil-making has been the business for so many generations. Our climate is congenial to the habit of the tree; it blooms from the 1st to the 10th of May, and the fruit forms from the 1st to 10th of June. At this season we have our best weather, free from extremes of either cold or heat. Nowhere in the world are all the conditions so favorable to the perfect fruit bearing.

FRUIT PICKING.

The olive usually ripens in November. In some localities in Eastern countries, during favorable years, the fruit picking for oil begins as early as October, and for pickling, in September. In Santa Barbara, the crop of last year (1880), as also that of 1878, was unusually late in ripening, not being ready to pick before the middle of January, a delay of fully two months, the cause no doubt owing to the extraordinary rainfall of these two years. In 1878 we had, after the middle of February, and up to the middle of April, a rainfall of over 14 inches, and in 1880 over 18 inches, being more than our yearly average.

The fruit should be gathered as soon as it turns purple, and before fully ripe, as the oil will be lighter in color and more fragrant, but somewhat less in quantity.

In Europe the common method of gathering the berries is to knock them from the trees with poles; they are then picked from the ground by old men, women, children, and cripples. This plan has serious objections, the fruit being more or less bruised, causing decomposition, and the contact with the earth is liable to give the oil an unpleasant taste and odor. The more economical plan of gathering is to pick from the trees by hand, and by the aid of intelligent contrivances an active man can pick 400 pounds each day.

I have arranged on a ranch wagon, platforms, with ladders securely fastened, so that the fruit from the different heights of even large trees can be gathered from the wagon, which is driven along the rows and one-half of the trees picked from each side. This plan obviates the necessity of moving ladders, climbing, &c., and relieves the pickers from the labor of carrying the fruit, as the sacks containing the same are always at hand on the platform. The leaves and imperfect berries are separated by passing the whole through a winnowing mill. This process leaves the fruit in the best possible condition, preparatory to manufacturing the oil.

MAKING OIL.

The berries are dried before crushing, as it is necessary to evaporate a portion of the water. If, however, they are left on the trees until shriveled, which is a proof that necessary evaporation has already taken place, no drying is needed after picking. This late picking is not best, as mentioned in a previous article. If dried by the sun, it requires about fourteen days. This plan cannot be depended upon in Santa Barbara, excepting in years when the fruit is early ripe and we have continuous sunlight, with moderately warm weather. By artificial heat, ranging from 110° to 130°, the drying can be done in less than forty-eight hours. The crushing and pressing should follow without delay; that is, the fruit taken from the drier in the morning should be cracked and pressed the same day. Long intervals or delays in the process from picking the fruit to expressing the oil tend to rancidity. To make perfect oil requires a perfect system in the whole management.

The capacity of the press, the crusher, the drier, and the number of pickers should correspond or be about equal; all fruit picked during the day should be in at night, cleaned the following morning, and go into the drier immediately after the previous day's drying is taken out. The heat or temperature of the drier ought to be so graded as to complete the work in forty-eight hours, and it is better that it should be under 130° rather than above.

The almost universal method of crushing the berries is by a heavy stone, similar to a millstone, which is rolled round on the edge in a deep circular groove or trough, and by its weight does the crushing. A beam passing through the eye of the stone, and working on a journal in the center of the circle, with a horse attached to the outer end of the beam, is the simplest way to do the work, and the plan that I have adopted.

The circumference of the trough depends somewhat on the size of the stone. The one I am using is 4 feet high, 6 inches thick, and the diameter of the trough in which it works, 6 feet; the length of the beam 15 feet. This crusher is amply sufficient for an orchard of one thousand trees, but too small for my purpose. It cost about $50.

A stone 5 feet in diameter and 2 feet thick would crush in eight hours a sufficient quantity of berries to make 100 gallons of oil, and by working it night and day, the crop of ten thousand trees. It would be better, however, to have two stones half the thickness of the above, one following the other in the same groove. The horse should work on the outside of the building containing the crusher.

To make 100 gallons of oil each day would require two good presses. The one best adapted for the purpose, so far as I have seen, is that used for making oleomargarine. Such presses could, with very little expense, be worked by the horse-power used for crushing the berries, so that one man could do all the crushing and pressing.

The press I am using is an old-fashioned wooden beam press, such as used in the New England and Middle States for making cider.

The beam is 26 feet long, and, with a heavy box filled with rock suspended at the extreme end, the power can be increased to 150 tons. The press with the differential pulleys cost about $150. Such a press cannot be improved upon for expressing the oil, but the additional labor, and the time lost in changing, is so much greater than what would be required for the oleomargarine invention, that the latter would facilitate the work and be cheaper in the end, besides taking up so much less room.

The crushed olives are put in the press in cheeses about 3 feet square, and 3 inches thick, with wooden slats between each cheese. Ten or more cheeses can be put in at each pressing. I use coarse linen cloth to contain the crushed olives.

The fluid that is expressed is put in large tanks, and left from sixty to ninety days, when the oil will separate, and being lighter will rise to the top, where it can be drawn off. The pumice after the first pressing is recrushed, and by pouring hot water over it a second quality of oil is expressed. The refuse can then be used either for fuel, for feed for pigs, or for making, still, a third quality of oil; if for the latter, it is thrown in vats, boiling water poured over it, and left to ferment, when the oil still remaining will be liberated and rise to the top.

FILTERING OR CLARIFYING.

This is a very simple process. The most common method is to have a series of five or six boxes, one above the other, each with cotton batting in the bottom; the oil passing the sixth will be beautifully clear, and ready for market. I use cylindrical tin vessels holding about three gallons each, one fitting in the other in tiers of three, with fine wire sieves in the bottom of each. On these sieves I place two or three layers of cotton batting. The oil is passed from one tier to the other until clear. The clarifying can be done by the sunlight; also it can be bleached and made much lighter in color, but not without injuring it. When it is adulterated, artificial heat is necessary in the process. When once heated it loses a part of the nutty flavor, and is liable to become rancid when exposed to the air. It should be kept in an ordinarily cool place, not exposed to the sunlight or heat, neither should it be handled any more than is absolutely necessary in the filtering and bottling, and should not be shaken after bottled. The mucilage contained in the oil will not separate for a long time after the oil is ready for use, and, as it does not injure it, is not, therefore, objectionable. It will sometimes form in the bottles like globules of water, or in films, settling to the bottom as sediment, and when shaken will give it a muddy appearance, which, with the common prejudice against all table oils that are not perfectly clear, renders it unsalable, as consumers consult more the eye than the taste. The oil is better when new and fresh, and what is gained in the appearance by its remaining a longer time in the tank is more than lost in its freshness and delicacy of flavor.

To sum up the cost of the machinery in the making of the oil, we have as follows: Drier, $150; mill, $250; two presses, $500; two tanks, $200; filterers, $50; corker, tin-foiler, $50; wooden building, $400. Total, $1,600.

SPECIAL REPORT ON CULTURE OF ENGLISH WALNUTS.

The cultivation of English walnuts in California has become of sufficient importance to warrant a brief chapter in this report. Finding it favorably grown at many points visited by the commission, and being advised that Mr. Russell Heath, of Carpentaria, Santa Barbara County, had been longer engaged in the industry, and was likely to be more experienced than any other cultivator in the State, from him the following detailed data were obtained.

We premise that other experimenters agree with Mr. Heath in the belief that all early plantings of this tree were made too close at the Wolfkill orchard, near Los Angeles; many inner trees were dying out, apparently from being too much crowded, the distance being 20 by 20 feet.

You are doubtless aware that the nut commonly called English walnut, or Madeira nut, is in reality the Persian nut. In Spain it is called "the nut"; in France, the same; in the island of Madeira, where it was first planted, the Madeira nut, &c.

Upon examination I find that in Persia it comes in bearing the eighth year from seed. In Spain and the south of France in about fifteen years. In England in about twenty. The climate of Santa Barbara is as near the climate of Persia, where it grows to perfection, as perhaps any place on this continent. Here the trees come in bearing the eighth year from seed.

The mode of planting in this State is to prepare the land same as for any nursery. The nuts are placed in rows, about 8 inches apart, and covered with 2 inches of earth. If the weather is warm the nuts sprout in ten or twelve days.

With regard to length of time to leave trees in nursery there is difference of opinion. I have changed my views after years of experience.

At present I leave trees in the nursery rows until they have attained the age of bearing; say, the eighth or ninth year. I have been led to this course for the following reasons:

If the tree is removed when one year old it is so small (3 or 4 inches high) that too much care is required in cultivation, and no advantage gained over transplanting older and larger trees. If transplanted at two years you would lose the two years in the nursery, because the tree will not produce fruit until in orchard full eight years.

If transplanted when three, four, or five years old, the tree ought to bear its first fruits in five years; or, in other words, you would gain nothing but size by selecting the four or five year old trees over the three-year old.

Trees should never be taken from the nursery when six years old, as at the sixth year the tendency is to top and not to root.

When trees are taken when eight or nine years old the top is pruned close, cutting back to about 9 feet. The side branches should be cut back to two or three buds from the body. Such trees will ordinarily bear the third year after transplanting, or as soon as the head has time to develop itself. You see it is the saving of time from transplanting to bearing that I have been after.

The time of coming into bearing is based upon our climate of Southern California. In most favorable localities in the States, west or north (east of the Rocky Mountains)

I do not think they would produce under fifteen or twenty years from seed. How much they would be retarded if taken from the nursery at eight or nine years, from this State to the east, I am not prepared to say.

My first orchard was planted 30 feet each way. Have since planted at different distances, and think the best about 40 feet each way.

You ask me how many bushels a tree will bear at what may be called maturity. I have never seen a tree at such an age. I am informed, in Spain and South of France there are trees believed to be over three hundred years old, which bear 15 to 18 bushels each. On some of my twenty-year old trees, I had 3 bushels each. These trees come gradually into bearing; the first year seldom exceeding four or five nuts; the second year, from 2 to 5 pounds; the third year I have had trees produce 40 pounds. But such are exceptional. I should say from 10 to 15 pounds a good yield. Nuts, with us, commence ripening about the last of September. My process of gathering is to start my men after the nuts have commenced to fall, slightly jarring each tree that the ripe nuts still on the tree may fall, picking in baskets, then taking to the drying house. We take the orchard row by row. Usually, with a good gang of hands, ten or twelve days are required to go through the orchard once. As soon as the first round is finished the second is commenced. In four or five rounds we usually gather the crop.

At the drying house they are subjected to a heat of about 200° for six or seven hours, the nuts not being removed until they are thoroughly cured, when they will keep for years, without becoming sour or rancid, in an ordinarily dry place. This mode of curing does not injure them for use as seed. They are then ready for market. There is a pernicious practice, often resorted to, of bleaching nuts with sulphur, to make them appear a light color. Some customers demand this; but sulphurizing should not be indulged in if a good wholesome nut is desired. I never bleach except at the particular request of customers. I think it materially injures the flavor, and only gives an unnatural color. My market has usually been the States west of the Rocky Mountains, although some shipments have been made to Chicago, Boston, and New York with good results. Prices range from 10 to 15 cents per pound, according to quality. I have about six thousand trees in orchard, from nine to twenty-one years old. I consider the investment a good one. I do not regret the years and money invested in this industry. True, there are no returns of consequence for a number of years. The tree is of slow growth, and must attain age before producing. From the fourth year the orchard may be said to be paying expenses, and from that time troubles and anxieties need not alarm you. You have something that ordinary drought does not effect. Of pests, I absolutely have none. The trees are healthy and free from disease.

FRUIT CANNING.

As the mode of utilizing green fruits by canning, jellying, and desiccating is, comparatively, of recent introduction in California, and forms an important adjunct to fruit growing, efforts were made by the commission to obtain data from a few establishments, situated in various parts of the State, in order that at least an approximate understanding of this industry might be had. To this end the following places were visited, and the extent of operations copied from the books kindly furnished:

J. LUSK, CANNING COMPANY, *Oakland:*

During the working season employed five hundred hands, principally Chinese labor. Experience has demonstrated that no other attainable labor can be relied on in this business. Ship goods to States east, England, and Australia. Eleven-twelfths of product is consumed in the United States. Fruit is put up 2½ pounds to the can; twenty-four cans in each case.

Put up for 1881 *to date of visit, October* 17.

	Cases.
Tomatoes	51,000
Apricots	10,000
Peaches	22,000
Pears	17,000
Plums	19,000
Strawberries	1,750

	Cases.
Blackberries	750
Raspberries	1,230
Grapes	4,903
Asparagus	520
Pease	12,001
Cherries	3,102
Gooseberries	823
Currants	7,710
Beans	1,000
Nectarines	800
Quince	900
Jellies and jams	3,998

Raised their own tomatoes; had 220 acres; paid $12 to $20 per acre, land rent; other fruits purchased; paid for apricots 3½ to 4½ cents per pound; peaches, 3½ to 5; pears, 3 to 3¼; plums, 1½ to 3½; strawberries, 5 to 6; blackberries, 3½; raspberries, 6 to 7; grapes, 2 to 2½; asparagus, 2; pease, 2; cherries, 5 to 7; gooseberries, 3; currants, 3; beans, 1 to 1½; nectarines, 4; quinces, 2 to 2½.

Freights from Oakland to Chicago, by rail, $1.50 per 100.

JOSEPH BLACK, *Santa Rosa:*

His first year, as an experiment, to date October 4, had put up—

	Cans.
Peaches	43,000
Pears	20,000
Blackberries	15,000
Plums	25,000
Tomatoes	4,000
Corn	25,000

Evaporated.

	Tons.
Peaches	15
Plums	5
Apples	10

Average prices about same as paid by the Lusk Company; some little variations; all shipped to San Francisco.

SAN JOSÉ PACKING COMPANY, *San José:*

To date October 11, had put up—

	Cans.
Tomatoes	400,000
Peaches	100,000
Apricots	150,000
Bartlett pears	150,000
Plums	150,000
Cherries	50,000
Blackberries	50,000
Currants, raspberries, and strawberries, each	20,000
	Tons.
Muscat grapes	30
Honey	100

Prices paid for green fruits range a shade higher than that of the Oakland house. Market, principally in cities east, largely Chicago and Denver; foreign trade—London and Australia—increasing; working season, May to October; use both American (female) and Chinese labor; "don't blush to employ Chinese labor," it being the most reliable; pay women and unskilled Chinamen $1 per day, best skilled Chinamen, $2 per day; Chinamen make cans and superintend cooking.

PACIFIC PACKING COMPANY, *Colton (San Bernardino and Riverside R. R. Station)*:

To date September 17, had put up—

	Cases.
Apricots	100,000
Peaches	150,000
Pears	10,000
Nectarines	10,000
Tomatoes	20,000

	Tons.
Dried fruits	10
Honey	200
Beeswax	2

This is a branch of the San José house. Prices and other incidentals same; about as at parent house. There are a number of other packing houses in the State—at San Francisco, Los Angeles, Sacramento, Santa Barbara, Gilroy, Napa, and other points. The above four, representing different sections, will suffice for the purposes of this report.

The total shipment of canned fruits from California, to September 1, 1881, were 283,940 cases over 253,354 in 1880; showing an increase in one year of 30,586 cases. Besides shipments to the Eastern States, these goods go to China, Japan, Sandwich Islands, Mexico, Southern and Central America, Siberia, Sumatra, Java, and India.

Varieties of peaches most desired for canning, and bringing the better prices in the order named, Crawford's Early and Late, Heath, and Lemon Cling.

NOTES OF EXOTIC FRUITS AND USEFUL PLANTS

ON TRIAL IN THE GARDEN OF ECONOMIC PLANTS, AGRICULTURAL COLLEGE OF THE UNIVERSITY OF CALIFORNIA.

BY E. W. HILGARD.

The subjoined data regarding some fruit-bearing and other economically useful plants that have been on trial for some years in the grounds of the University of California are mainly drawn from reports made on the subject by Mr. W. G. Klee, gardener in charge.

THE DATE PALM (*Phœnix dactylifera*).

This, even as a young seedling, is perfectly hardy here; but, as most palms, a very slow grower the first years. This wonderful tree seems to have found another home on the Pacific slope, where the conditions of climate resemble most closely that of its Asiatic home, viz., dry heat and absence of rain during its fruiting season. Dates have been fruited in California all the way from the bay region to San Diego; but all having been grown from seed, the fruit has almost throughout been of very inferior quality. Yet well-tasting dates have been produced, as, *e. g.*, last year, 1881, in Solano County; sufficient to prove that this tree of the desert is adapted to this climate. It is very desirable that sprouts of valuable varieties should be introduced from the Old World for propagation here, the more as such trees thus grown bloom in one-third of the time required for seedlings. (See, also, remarks on "Timber Trees," above.) Excellent dates, however, are produced at several points in the peninsula of Lower California, whence they are regularly supplied to the market of Guaymas.

THE CAROB TREE (*Ceratonia siliqua*).

This seems quite hardy in this region, as young seedlings resisted the frost of 1879. It is, however, a very slow grower the first season, until it becomes thoroghly established, after which it is comparatively rapid. A young tree with the best of care, has only made about 10 inches of growth during the whole season. In subsequent seasons the growth is quite rapid, shoots of 18 to 24 inches being made at the ends of the branches during the growing season. It has withstood without injury a temperature of 25° Fahr. In some localities it has been severely affected by the white scale (*Aspidiotus nerii*), which also infests acacias, oleander, pomentaceous trees, &c.

THE CAPER BUSH (*Capparis spinosa*).

Seed of this shrub was procured from New York, but only two plants were raised from this; they were, however, increased by cuttings that grew quicker than the seedlings. In the garden this has been of very slow growth. Early frosts this season (1881–'82) have killed all the young wood, but the plants will no doubt recover. It will doubtless be found hardy in all ordinary seasons in the Los Angeles region.

ZIZYPHUS VULGARIS AND JUJUBA.

Two species, furnishing the jujube paste, are both growing luxuriantly here. The first has fruited in Sonoma, but has not answered expectations. The latter may probably be superior. The leaves and young wood are killed here every winter.

CUSTARD APPLE (*Anona Cherimolia*).

This delicious fruit belongs really to the tropics, but may possibly find sheltered localities where it will do well. It is quite a rapid grower, making shoots 2 to 3 feet in a season outdoors, and twice that in the greenhouse. It is raised easily from seeds, but seems to be difficult to propagate from cuttings. It requires at least partial protection in winter here, but ought to be hardy farther south.

THE SOUR SOP (*Anona muricata*).

There is still less probability of rearing this tropical fruit out doors. Two plants set out in the garden at the same time' as the *Cherimolia* died very soon after, and it has never made much growth even in the warmest place in the greenhouse.

ANONA, OR ASIMINA TRILOBA.

The Papaw of the Eastern States, and the representative of the custard apple there, has shown itself rather delicate in transplanting, but some plants have done comparatively well, and have reached about the height of two feet in three seasons.

The Calabash Tree (*Crescentia cujute*) has been fruited in Solano County.

THE TAMARIND (*Tamarindus indica*).

This tree seems very slow here. It has never progressed outdoors, and seems almost equally slow indoors.

THE JAPANESE PERSIMMON (*Diospyros kaki*).

This fruit, which seems destined to become of considerable importance to California, has ripened fruit in Berkeley, but of small size compared with specimens from Japan, and rather astringent. The variety, however, is doubtless of inferior quality, having been introduced three or four years ago, when the great difference of the varieties was not so well known. There is now on hand an assortment of twenty of the best varieties.

The persimmon is of moderate growth here, and the failure of a good many people, especially in this neighborhood, to make their trees grow, is probably only due to an omission to get their soil deeply worked, as the tap-root of persimmon is evidently intended to penetrate very deeply into the ground. The earth in the holes ought to be loosened two or three feet deep. Small consignments of the fruit, of excellent quality and large size, have been received at San Francisco from the southern part of the State for two years past.

Diospyros lotus, of Southern Europe, is a rapid grower here, and a promising stock for grafting the Japanese persimmon. It has a tendency to continue in growth late in the season, so as to be caught by early frosts.

PERSEA GRATISSIMA.

The Aguacate (commonly mispronounced Alligator) pear of Central America has resisted surprisingly the severe weather of the present winter (26° F.), only the tenderest shoots at the ends of the branches being hurt. It is a rapid grower, and may prove valuable in the southern part of the State.

The pear-shaped "Guava" (*Psiduim pyriferum*) has been cut down by the frosts of the last three years; hence must be considered a failure in the bay region. Favorable reports, however, have come from the southern part of the State, where it has been fruited. *Psidium cattleianum*, the Strawberry Guava, is, nevertheless, perfectly hardy with us, and promises well from here southward.

Excellent samples of ripe yellow guavas have been brought from Santa Barbara, and the same, as well as other varieties, have been grown near Los Angeles; but thus far no market has been found for the fruit, and not enough has been grown to encourage the manufacture of jellies.

MACADAMIA TERNATA.

This is a Queensland tree that produces a very finely-flavored nut. It is a near relation of the *Grevillia robusta*, known as Australian Fern Tree—a very ornamental tree of our gardens—but its leaf resembles more a holly. This tree is, doubtless, also perfectly hardy, but it is a slow grower during its first years. It was grown from seeds.

The Japanese Chestnut seems to excel even the largest Italian in size and flavor. It is easily grown from seeds, growing a couple of feet the first season. It is of slender habit, and is disposed to sucker; would seem to be adapted to the formation of hedges here. It is said to bear well already the fifth year.

CARICA PAPAYA (*the Melon Tree or Papaw of the Antilles*).

This tree grew well out of doors during the last summer, but succumbed to a frost of 28° F.; with some protection it would probably resist, as does its relative, the *Vasconcella hastata*, which, though a native of the West Indies, and apparently more soft and spongy in its stem than the "Carica," only suffered slightly at a temperature of 25° F. *Berberis heterophylla*, the edible barbery of Turkestan, is a hardy, deciduous shrub of rapid growth.

THE JAPAN VEGETABLE WAX (*Rhus succedanea*).

A Japanese tree belonging to the sumac tribe. Yields from the coating of the seed a substance similar to beeswax. The tree has been found to be a free grower here, making shoots several feet in length during the season, and is quite ornamental, resembling the Staghorn Sumac. *Rhus vernicifera* yields the genuine Japan varnish. It is a tree of similar habit as the Vegetable Wax. It has, though planted late, made a very fine growth. Both are deciduous and perfectly hardy.

THE CINCHONAS.

Strong hopes have been entertained that some species at least of these valuable trees would succeed in California; and so far as the hardiest, which it has not yet been possible to obtain for trial, this hope may still be indulged. In 1879 a lot of seeds grown in India, and embracing the species and varieties *C. Condaminea*, *Calisaya*, *Succirubra officinalis*, and a *Hybrid*, were obtained through the courtesy of Sir Wm. Robinson, ex-lieutenant governor of Madras. In accordance with the suggestion of the donor, the seeds were at first sown in boxes kept at 75° with bottom heat; in these the *Calisaya* and the *Hybrid* sprouted in three weeks, whereas the others remained dormant for five months. They were then removed to a cold frame with a temperature of from 55° to 60°, where quite a number germinated.

Afterwards sowings were made in cold frames and good results obtained. A large number of seedlings were lost by damping off, probably under the influence of a somewhat objectionable spring water used in watering; and even well-grown plants showed a somewhat inexplicable tendency to sicken and lose their leaves when kept in the house continuously for a length of time. A number of each kind were set out in the open ground in the "Garden of Economic Plants"; the general result being that especially the *Calisaya* and *Succirubra* did well and grew rapidly, some reaching the height of 3 feet. Then came a season of violent, dry northers, which injured especially the large leaves of the *Calisaya*. The latter and the *Succirubra* survived the winter of 1880-'81 with a little protection, the tender ends only being killed, while the others were killed down to the ground, but being promptly cut off sprouted again in spring. The low temperature of the present winter (1881-'82), however, has finally killed all to the ground; and it must be admitted that where winter temperatures as low as 25° are likely to occur, these cinchonas cannot succeed. This, unfortunately, may happen even as far south as San Diego at long intervals, as was shown this season. The cinchona plants distributed last season to the southward have not as yet been heard from as to their resistance, but there is little reason to hope that they have survived the unusually severe winter, unless, perhaps, on Santa Rosa Island. There yet remains one species, said to be hardiest of all, viz., the *Cinchona pitayensis*, of which no seeds have thus far been obtainable. It would be very desirable to determine whether this specie will resist our winters, for it has somewhat unexpectedly been shown that the cinchonas do not require a very large amount of moisture at the roots, at least, as they have remained unirrigated for three months at Berkeley, and were injured only under the influence of a very severe "norther," but even then not materially.

TEA PLANT.

The Tea Plant seems to be a complete failure all along the coast, but reasonably good results have been reported from the foot hills of the Sierra. Tea plants are unthrifty even in the propagating houses, and in private grounds under the best of care. They have almost invariably died out after a year or two of precarious existence. Of over a thousand healthy plants set out by Mr. Wm. Hollister, at Santa Barbara, but a few dozen were alive in 1880, and these very weakly. It seems improbable that practical success can be looked for anywhere in California in the cultivation of teas.

The hardier kinds of coffee seem to survive the ordinary winters of

South California, but any unusual cold is fatal to them. The limit of their existence is too nearly reached to render their culture at all promising, even in Southern California.

It is desirable that the culture of the *Mate* (*Ilex paraguayensis*) should be tried in California. Our efforts to procure its seed have thus far failed. The coca tree (*Erythroxylon coca*), whose leaves are now in demand for medicinal use, is very likely to be found hardy, both as regards drought and cold, in Southern California.

PLANTS WORTH TRYING IN CALIFORNIA.

[Report to the State Horticultural Society on Baron V. Müeller's "Select Extra-Tropical Plants,' eligible for industrial culture or acclimatization, &c., with additions and comments by Herman Behr, M. D., and W. G. Klee.]

In submitting this report to the members of the society, we desire to state that neither our time nor opportunity have allowed us to investigate the matter as thoroughly as we might have wished to do; especially should we have liked to gather information relating to various plants which, there is reason to believe, have already been introduced into some part or another of this large State.

We concluded, however, that we probably would do the society and horticulturists at large greater service by offering the report, such as it is. We cherish the sincere hope that by doing so now the attention of horticulturists will be called to the desirability of co-operation, and mutual benefit result from interchange of experiences which should be the aim of the horticultural society. For, if persons who, perhaps, have tried one or several of the plants named, would communicate with us, stating their experience, some most valuable and more definite information might be gathered and published before the season for sending for seeds or plants. In regard to the arrangement of the plants enumerated, we have chosen to divide them according to their uses rather than to take them alphabetically, irrespective of qualities. We have commenced with the largest division, the plants yielding edible fruits, tubers, &c., and propose to give at an early date, in their order, medicinal plants, plants of technical value, shade and timber trees, trees and shrubs adapted for tide lands and alkali lands, forage plants, and, lastly, ornamental trees, shrubs, &c.

I. PLANTS YIELDING EDIBLE FRUITS, TUBERS, ETC.

Arracacha Xanthoriza (*Umbelliferae*).—Parsley family. Mountains of Central America, also Peru. The tubers of this plant are eaten. It would probably be hardy.

Averrhoa Carambola (*Oxalideae*).—A native of the Himalaya Mountains. This is a small tree that is cultivated in the Orient for its fruit, which has a pleasant, currant-like taste. There occurs a sweet and acid variety.

Argania Sideroxylon.—The Argan tree, or iron wood of Western Barbary (*bumeliaceæ*). The seed of this tree furnishes an oil, and the fruit is also used for cattle feed, while the wood is very hard, suggesting its name. The tree is on trial in the Garden of Economic Plants, at the State University. It may be propagated readily from cuttings, which has been done here.

Aralia cordata (*Araliaceae*) *China*.—The young shoots of this plant are used as asparagus. This plant is on trial at the Garden of Economic Plants, in Berkeley, where it seems to flourish; it is perennial, resembling the wild California species in habit.

Adenostemon (*Prunus*) *nitidum* (*Laurineæ*).—South Chili; a laurel-like evergreen tree, with an edible fruit. Guelue, Nuble, and Aracua are in Chili various names for it.

Brabejum stellulifolium (*Proteaceæ*).—South Africa, a beautiful evergreen tree, with an edible fruit, which, however is poisonous in a raw state. Seeds were donated to the university by B. Ferd. von Mueller, but failed to germinate.

Benincasa cerifera (*Cucubitaceæ*).—Cucumber family. The fruit of this gourd yields a kind of cunie. Seeds of this are advertised for sale in James Thorborn's catalogue, of New York.

Cajanus Indicus.—Known as the Congo pea or catjang (a very desirable bean); deserves trial.

Capparis spinosa (*Capparidæ*).—The caper bush. The flower buds of this plant yield the caper of commerce. The shrub is on trial at the Garden of Economic Plants, at Berkeley, where it stood the test of last season well, but seems to be of very slow growth.

Carum bulbocastanum.—The tubers of this umbellifer are used as food under the name of earth chestnut. There is no reason why it should not succeed here.

Chaerophyllum bulbosum.—The parsnip chervil is a good addition to the kitchen garden, if not already introduced.

Colocasia Antiquarum.—This plant is well known as an ornamental foliage plant.

The variety "edulis" is the taro of the Polynesian Islands or tanya of the Southern States; is cultivated for its tubers in almost all tropical countries.

It has stood the winter in the open air at Berkeley, and is now, in April, green, with large leaves. We believe that the cultivation of this productive plant has been tried with success in Alameda County.

Corylus Coluna.—The Constantinople nut tree bears a well-flavored hazel-nut, and reaches a height of 60 feet, and is, on the whole, well worth introduction, as is also the Japanese hazel nut.

Corylus heterophyla.—*Diospyros lotus*, the Italian persimmon (*Ebenaceæ*), and *Diospyros virginiana* are both being tried in various parts of the State. We have found the latter (the American persimmon) to be of very slow growth here in Berkeley.

Pueraria tuberosa.—From South Asia, is a tall, woody climber, belonging to the pea family (*Leguminosæ*), the tubers of which are long, and rich in starch; it is perhaps the same species as *P. Sieboldtii*, that in Japan furnishes a superior starch. This plant has been tried with success in the Garden of Economic Plants, in Berkeley, where it grows without irrigation, sending out vines 12 to 15 feet long in a few months.

Soja hispida.—The Soja bean of Japan and China. The catalogues of France and Germany are making considerable comment on this bean as something very desirable, the most nutritious bean, &c. It is said to yield well and succeed in North Germany. Seed of this bean received from San Francisco Bulletin resembles closely a bean introduced some two years ago from China and tried in the Garden of Economic Plants, in Berkeley; if the same, it is not to be relied upon as a sure crop in this locality, but indications are that it would yield a large crop in a little warmer locality.

Guevina Avellana, or Quadria heterophylla; Proteaceæ.—Ferd. von Mueller refers to this tree as one of the most beautiful in existence, and no one will deny this when he sees the tree, even without flowers. The pinnate large evergreen leaves are of a dark-green, glossy color, shining from afar, and the young purplish buds are clothed with a thick down; add to this snow-white flowers of the delicate structure peculiar to Proteaceæ hanging in profusion all over the tree, and you have a sight not easily forgotten. Besides its beauty, this tree is very useful; its fruit has an agreeable, nut-like taste, but is, like the Brabejum, poisonous in a raw state, and has given the tree the name of the Chilian nut tree. It has proved perfectly hardy in Berkeley, and of comparatively rapid growth when established. Though most easily propagated from seeds, this tree can also be propagated by cuttings, as has been done at the Garden of Economic Plants, in Berkeley.

Maranta arundinacea.—Is the true arrowroot of commerce. The culture of this plant is comparatively easy. It has, as far as we are aware, been cultivated with success in Fresno County.

Dioscorea, yam.—*Dioscorea hastifolia* is native of Western Australia; is recommended as very hardy. *D. japonica*, the Japanese, and *D. glabra* (*Batatas*) deserve trial. The latter has lately been distributed by the San Francisco Bulletin. *Dioscorea alata*, the Uvi yam, is a species that hails from the South Sea Islands, but has been grown successfully in New Zealand, and would most likely flourish in parts of California, where too early night frosts do not occur.

Hovenia dulcis, Rhamnaceæ.—Originally from India, but introduced to China and Japan, where it is cultivated for its fruit. It is a pretty deciduous tree, with a large linden-like leaf, and of comparatively rapid growth. This tree is also on trial at the Garden of Economic Plants, in Berkeley.

Juglans Sieboldtiana.—A Japanese walnut, known in California as the Towerhouse walnut, being grown first by a Mr. Towerhouse, of Shasta County. It is a valuable addition to the nut trees, and deserves to be better known. *Juglans cordiformis* is a nearly allied species, probably also worth a trial.

Macadamia ternata.—The Queensland nut tree (*Proteaceæ*). Is a beautiful evergreen tree, producing a good size nut of a highly pleasant taste. This tree is easily raised from seed; is perfectly hardy in the milder coast climate. It is here in Berkeley a little slow, as is most of its relations, the first two or three years. As a number of seeds were imported last year, we will no doubt hear from various parts of California in regard to its adaptability.

Maclura Mora, a near relation to the Osage orange. Is a native of North Argentia; therefore probably hardy; the wood of this tall tree is valued for its toughness, while its fruit is edible.

Mangifera Indica, the mango.—This much-esteemed tropical fruit has, perhaps, been tried in California already; if not, it deserves it, for it is in many instances very hard to predict the adaptability of a tree. We know of more than one tropical tree that has proved hardy in spite of probabilities.

Marlieria glomerata (*Myrtaceæ*).—The *Cambuco* of the sub-tropical Brazil, deserves trial as the fruit is large and wholesome.

Marlieria tomentosa.—The Guaparanga, bears sweet fruit that are the size of cherries. Is found in the same region, and very likely also hardy.

Melocanna bambusioides.—The berry-bearing bamboo from Chittagong (India). This bamboo deserves introduction and trial perhaps more than any other. It is of large growth (70 feet high), erect, and bears a fruit the size of an apple, the seeds of which are said to be very palatable. Combining this good quality with the usefulness of bamboos, it recommends itself specially, as it is said to grow on dry slopes of hills.

Moringa pterygosperma (*Leguminosæ*).—The horseradish-tree of India. Edible pods, with only almond-like seeds, from which a valuable oil, used by watchmakers, is pressed. The tree occurs in the mountains, and has been transplanted to various countries. In India there is a prevailing belief that this tree is a protection from lightning.

Morus Nigra.—The black mulberry and its improved varieties deserve planting more along the coast. It succeeds well with mild summer temperature and foggy damp weather. We are aware of a very old tree that for centuries has borne fruit on one of the smallest islands in the Danish waters. Though the weather here is often extremely rough and the soil very sandy and poor, the tree continues to flourish.

Nephelium Let-chi (*Sapindaceæ*).—The fruit of this tree is the Lit-chi of the Chinese, well known as the Chinese nut. The tree would doubtless be hardy here; care, however, must be taken to procure fruits that have not been prepared for the market, as they have been heated to such a degree as to destroy the germinating power of the seed.

Nephelium lappaceum.—The Rambutan or Rambostan of India, is an Indian tree belonging to the same genus. It produces a similar fruit to the Let-chi. There is reason to believe that this tree would be hardy in sheltered localities.

Parinarium Nonda (*Chrysobalaneæ*).—The Nonda tree of North Australia, might perhaps be utilized in the more arid southern part of the State, where its plum-like but mealy fruit would be appreciated.

Persea gratissima.—The *Agual cate* of the Mexicans, or, as it is also called, the Alligator pear. This laurinæcous tree, so well known, from the tropics, will bear the open air with slight protection, in the locality of Berkeley, and should be tried more extensively. It is readily raised from seed.

Peumus boldus (*Laurineæ*).—The Boldo of Chile, undoubtedly introduced and distributed by the San Francisco Bulletin. Plants raised from this seed are yet too small to be judged. The wood of this tree is the most valuable part of the tree, but the fruits are also sweet and edible.

Pistacia vera (*Terebinthaceæ*).—This, the true Pistacia nut, was, as we have lately learned, introduced by Mr. Rixford in Sonoma some years ago. It will probably flourish in the greater part of the State. Seeds have lately been purchased for the Garden of Economic Plants, in Berkeley, and plants will in due time be used for distribution. Good seed can be obtained of Vilmorin, Paris.

Pyrularia edule (*Santalaceæ*).—From Sikkim, Nepal, and Khasia; is a fine shade tree, the fruit of which is edible.

Sechium edule (*the Choco or Chayota*).—An Indian climber, of the cucumber family; has a starchy, edible root, and also good-size fruits, that are eaten. It is said to be very productive; comes to perfection in the warmer parts of the temperate zone.

Solanum Quitoense.—If this shrub would be hardy here, what is not unlikely, we would have a fine addition to our solanaceous fruits (tomato, egg plant, &c.). The fruit of this is the size of a small orange, of its color, and also of similar taste.

Solanum Vescum and (*laciniatum*).—Yields the gunjang of the Australian aborigines, also an edible fruit that deserves trial. *S. Laciniatum* is hardy in sheltered localities in Berkeley.

P. Sterculia Carthagenienis Sterculiaceæ.—All the sterculias are highly ornamental both for fruit and flowers. This tree produces seed with almond taste. There is also a Chinese species, *St. monos perma.* Both would probably flourish here.

Telfairia pedata.—A gigantic climber, belonging to the cucumber family. The flowers are most elegantly fringed, and lilac colored. The large fruit, attaining a size of 60 pounds, is edible in a cooked state, while the seed contains a large quantity of oil. The home of this plant is Mozambique, and it is perhaps doubtful that we could grow the plant, even in sheltered localities, out-doors, but it is certainly worth a trial.

Terminalia Catappa (*Combretaceæ*).—In mountain regions of India. Roxburg mentions this tree as the most beautiful, bearing seeds that are wholesome as well as of an agreeable taste. Mueller puts this, as well as the previous one, among the doubtful (hardy); but, as we have mentioned before, the home of a plant is not always a sure guide, only actual trial determining the constitution of a plant. We also recommend this tree.

Vaccinium macrocarpon.—Is the well-known cranberry of the Eastern swamps. Of the numerous species mentioned by Mueller, this is no doubt the most important. Though so well known, it is but of late years that cranberry culture has taken any proportion in California. We cannot urge the planting of this little bush too strongly, especially in localities subject to fresh-water inundations and with soil of a porous nature, such as is found on many of the islands of the Sacramento.

Ximenia Americana (*Olacineæ*).—This highly ornamental tree is found in many different countries; is also indigenous to Florida. Though the fruit perhaps is more ornamental than pleasant, it deserves trial, as it might be improved.

II.—MEDICINAL PLANTS.

Aloe ferox.—One of the hardier aloes, deserving trial, as it yields one of the best Cape aloes.

Barosma serratifolia.—Rutaceæ, also native of Cape of Good Hope, is a small bush yielding the buchu of commerce. Judging from the number of Cape plants succeeding in California, we think it worth a trial, inasmuch as it might prove a very profitable culture.

Cassia acutifolia.—The leaflets of this species furnish part of the Alexandria senna. It is a perennial plant, much of the same habit as the Maryland senna, and might easily be protected from frost if not quite hardy. *Cassia fistulosa* is perhaps a hardier species. It is the pods of this that are utilized; besides its usefulness, it would be another very ornamental tree added to our gardens.

Cinchona Calisaya.—The source of the yellow or Calisaya bark, and also of part of the crown bark, is found in Peru, New Granada and Bolivia, at an altitude of 5,000 to 6,000 feet. The trees attain a height of 40 feet. There appear to be many varieties of this species; a Santa Fé variety ascends to 10,000 feet elevation. *C. Calisaya* has been and is being tried yet at the experimental gardens of Berkeley. Specimens which escaped the early November frosts at as low a temperature as 28° F. were killed afterward by the moist cold, which never was actually as cold by measurement as previously. Seeds of these were from Indian plantations, where this species thrives, but it would be very desirable to obtain the hardier varieties, as, for instance, the Santa Fé variety.

Vilmorin-Andrieux, of Paris, have seeds for sale of various cinchonas, among them *Calisaya*, var. *anglica*, which is supposed to be from India, and *Calisaya*, var. *Javanica*. The price is very reasonable, 6 francs for 10 grams of good seed.

Cinchona nitida.—The source of the gray or Huanaco bark is one of the largest growing of the Peruvian bark trees, reaching under favorable circumstances the height of 80 feet, judging from the locality (high elevation of the Andes in Peru and Ecuador). Von Mueller thinks this species one of the hardiest; we are not aware of this species having been tried in California.

Cinchona officinalis.—Andes of Peru and New Granada, at an elevation from 600 to 10,000 feet; yields the brown or crown Peru bark, besides part of Loxa bark. This species is averse to a superabundance of moisture, and among its several varieties there will probably be found the hardiest of all cinchonas, the Crispilla variety; it is said to endure an occasional frost as low as 27°. The *officinalis*, and what perhaps is the same, *condaminea*, have both been grown from seeds in Berkeley. Like the Calisaya, they resisted the early frost of November and lived through the winter by a slight protection, but a decay of the stem set in late in the spring after they had commenced to start, from which they never recovered.

Cinchona lancifolia, Weddell.—Considered a variety of *officinalis;* grows in places where the mean annual temperature is that of Rome, with, however, less extremes of heat and cold. Seeds of *lancifolia* may also be obtained of Vilmorin-Andrieux, in Paris. Seeds from this source are now sprouting at propagation houses of the experimental grounds in Berkeley.

Cinchona pitayensis is another variety that in Upper India has brought some of the best results. It is a tree 60 feet high. Still another kind, *Cinchona kasskarliana*, may perhaps belong under *officinalis*, though the seeds are very much smaller—at least such is the case with samples of this kind procured from Vilmorin. This species has in Java proved very valuable, and deserves, like the rest, a thorough trial.

Cinchona succirubra, from the Middle Andine region of Peru and Ecuador, is a tree attaining a height of 40 feet; the source of red Peruvian bark. This species has in Berkeley borne out its reputation of being one of the hardiest of bark trees, being the only one of four species that has successfully survived the winter by a very slight protection, and it will probably be this kind that will be found to be the most paying here, as it seems to have been in other countries.

Camphora officinarum, or *Cinnamomum, camphora*, *Laurineæ.*—The camphor laurel of China and Japan is one of the most beautiful of evergreens, the varied-colored hue of the foliage from purple to light green contrasting finely with yellowish branches. Apart from that, it may become of great value as the source of camphor. It should be planted in the garden, park, and promenades as a shade tree of peculiar beauty. It will most probably be found to be perfectly hardy in all the valleys of California, as it has been tried with success in various parts of the State. In Berkeley it has proved a fast grower, and the young foliage would seem even to be untouched by severe frosts. It is, on the whole, a tree that cannot be recommended too highly.

Colchicum officinale.—In the northern part of this State, where moist meadows occur, this pretty perennial herb would flourish, and might be sold with profit to the drug stores.

Dorema ammoniacum; Umbelliferea.—Is a tall perennial herb that yields a gum resin. Is a native of the mountains of Persia, and would be likely to flourish in the greater part of the State.

Ecbalium elaterium.—The squirting cucumber; Cucurbitacea; yields a powerful purgative. Being a native of a similar climatic region, the Mediterranean, it is apt to succeed in California.

Eryngium sumbrel.—An umbelliferous herb from Central Asia; recommended as a remedy for various diseases. As far as hardiness goes, this plant must certainly be adapted to the climate. Seed is advertised for sale at Haage & Schmidt's, Erfurt, Germany.

Ferula galbanifera.—Another umbelliferous plant to be recommended for mountainous regions. It is a perennial, yielding the gum resin galbanum.

Fraxinus ornus.—The manna ash. Though this tree, known as the flowering ash, is cultivated in California, it ought to be planted more on the streets and in parks, being very ornamental, as well as the source of the medicinal manna.

Gelsemium nitidum, Loganiaceæ.—Is the false yellow jessamine of the Southern States, a climber of considerable importance in medicine. It will most likely succeed in California.

Brayera anthelmintica or *Hagenia abyssinica.*—The kusso is a tall, handsome tree, belonging to the rose family, and a near relation of our mountain mahogany (*Cercocarpus*). As the specific remedy for tape-worm this plant is of great importance, and being a native of the higher elevations of the Abyssinian mountains, is likely to flourish in the greater part of Central and Southern California.

Helleborus niger, Liliaceæ.—The Christmas rose, or black Hellebore, so well known on account of its time of flowering in midwinter, even in cold climates. It is perfectly well adapted to the cooler regions of the State. It is the root that is used medicinally.

Hydrastis canadensis, Ranunculaceæ.—The yellow puccoon, utilized in medicine, as well as for coloring, and would most likely thrive in the moist coast counties.

Ilex Paraguayensis.—The Paraguay tea, or mate. The leaves of this holly are used as a tea by millions of people in Uruguay, Paraguay, and many other countries throughout South America. Though it perhaps never would find much favor with people accustomed to tea, it deserves cultivation trial as the source of a highly stimulating product. Its nativity places it among the doubtful plants as regards hardiness.

Illicium anisatum.—The star anis of China and Japan, is a beautiful evergreen small tree belonging to the magnolia family. The star-shaped fruits are used in medicine. This species has small and yellow flowers, and should not be confounded with the *Illicium religiosum*, one of the sacred trees of the Japanese, that has pure white flowers.

Krameria triandra.—The ratanhia root is furnished by this polygalaceous herb. It is indigenous to Chile, Peru, and Bolivia, where it grows on sandy soil, and would most likely thrive in similar localities in this State.

Pistacia lentiscus, Terebinthaceaæ.—The mastic tree is a tall evergreen bush, yielding the mastic resin; is a native of the Mediterranean region, and most probably well adapted to many localities in this State.

Pistacia terebinthus is also a native of the Mediterranean region; is a tall bush or small tree, yielding the fragrant Cyprian or Chio turpentine which is an exudation from the stem.

Polygala Senega (the Seneca snakeroot), *Polygalaceæ.*—It is probably well adapted to parts of California. It prefers a well-drained soil, and is generally found among rocks in its native home, the Eastern and Southern States.

Rafnia perfoliata and *amplexicaulis* are South African leguminous bushes, with sweet roots, the character of licorice, and possessing medicinal properties.

Schaenocaulon officinalis.—A near relation of the false hellebore (*Veratrum*), a native of Mexico's mountainous regions. It might doubtless be acclimatized in Southern California, and be made to produce its seeds, that are the sabadilla used in medicine.

Smilax officinalis of New Granada and *Smilax medica* of Mexico are among the many sarsaparilla-yielding species; two of the more important, and perhaps likely to flourish in sheltered localities.

Spigelia Marylandica.—The pink-root, *Gentianacea* or *Loganiaceæ.* As this plant possesses strongly medicinal properties and is a very showy plant, it naturally recommends itself.

Styrax officinalis, Styraceæ.—This shrub is a native of the Mediterranean region; is the source of the fragrant solid storax. Judging from its nativity and the fact that California itself is the home of a true styrax, we recommend it for trial.

Swertia Chirata, Gentianaceæ, is a perennial herb from the mountains of India, possessing febrifugal properties. It is also known as a fine tonic.

Chrysanthemum (*Pyrethrum*), *Roseum*, and *Carneum*, insect-powder plants.—As the cultivation of the *Pyrethrum cinerariefolium*, or Dalmatian fever few, has been started on a large scale. It deserves notice that besides the named species, there are five others that are utilized for this purpose, viz., *tenuifolium*, *Wildenswii*, *persicum*, *corymbosum*, *macrophyllum;* and though some have settled on the Dalmatian, others may be equally or perhaps better suited to some localities than others. The difficulty that has been experienced in getting seeds of the various kinds is now passed, as Professor Riley has sent seeds of *roseum* to several places in the State, and the Stockton firm have decided to sell their seed of "*cinerariefolium*."

Quillaya saponaria (*Rosaceæ*).—The Spanish bark or soap bark of Chile is the product of this tree. It reaches an enormous size. Seeds are very light and apt to be abortive. Due care should be taken to have them perfectly ripe for shipment, or they will not keep.

Rhamnus chlorophorus (*Rhamnaceæ*), Buckthorn family.—From the bark of this Chinese tree a very superior green color is derived, utilized particularly for silk. *R. utilis* is another species used for the same purpose. The dye from these trees is called lokao.

Rhus vernicifera, *Terebinthaceæ*, is a medium-sized tree of Japan, yielding the true Japan varnish. This, and also its close relation, *Rhus succedanea*, are both well adapted to the climate around the bay, as trees grown in Berkeley show.

Rhus coriaria.—The tanner's sumac is a South European species, the foliage of which is extremely rich in tannin, and in great demand. This species can doubtless be grown with success on dry ground, as the plant not alone prefers it, but its product here is superior. The attention should be called to properties of the native California sumac that are very rich in tannin, *Rhus integrifolia* especially, an evergreen species abundant on the southern coast. The poison oak (*R. diversiloba*) might no doubt also produce a fine varnish, if the way of handling it with impunity could be found.

Pogostemon patchouli.—A labiate (mint-like) herb that produces the patchouli so much used as a perfume. It deserves notice that the seeds of *Hibiscus Abelmoschus* (*Abelmoschus* by the Germans) has been introduced to this country, the Department of Agriculture having twice received seed of this from two different sources. The true *patchouli* is a native of the mountains of India.

Liquidamber Formoseana.—From China, gives a species of sweet gum utilized for feeding a kind of silk-worm.

Liquidamber orientalis.—From Asia Minor, yields the vanilla-scented liquid storax, prized in perfumery.

Nicotiana persica.—The Shiraz tobacco, is recommended as adapted for more moist and cool climates.

Vahea florida, *Apocynaceae.*—A native of West Africa, but found up to 2,500 feet elevation. Is a beautiful climber, with white, fragrant flowers, the plant yielding caoutchouc.

OIL-YIELDING PLANTS.

Guizotia oleifera.—From India, and perhaps Abyssinia; is the source of the Ramtil oil, utilized like the Bene oil (*sesamum*), for culinary purposes as well as in various industries. It is a yellow-flowered, coarse-looking composite herb, that seems perfectly adapted to the bay climate, maturing in Berkeley good seed, where the season is too cold for the Bene. The seeds of this plant are also known as Niger seeds in the London market.

Madia sativa grows as a common weed (tarweed) all over California. It would so much the more be successful under cultivation. The same is conspicuously true of the *rape* (*Brassica rapa*), which, under the designation of "wild turnip" or "white mustard," is everywhere obnoxiously familiar. In the valley and in Southern California the black mustard, *Brassica nigra*, is almost ineradicable, and ought to be made subservient to human uses.

The *sunflower* and *flax*, as well as the *castor bean*, succeed admirably.

PLANTS YIELDING WAX.

Stillingia sebifera (*Euphorbiaceæ*).—The tallow tree of China; has been naturalized in some of the Southern States, and is probably perfectl yhardy in the greater part of this State. A vegetable tallow is derived from the coating of the seeds; hence the name.

Rhus succedanea, the Japanese wax tree, has been referred to above. It grows like a native.

DYE PLANTS.

The various species of *Indigo*, *Indigofera*, *Anil*, and *tinctoria* are doubtless well adapted to the southern part of the State so far as heat is concerned, but with irrigation and consequent additional labor it is perhaps a question whether it could be produced at a figure low enough for competition.

The Madder, *Dyer's Weed*, *Safflower*, and other dye plants flourish, their successful production being purely a question of demand and price of labor.

FIBROUS AND MISCELLANEOUS PLANTS.

Maoutia Puya.—Is a stingless nettle like the Ramie, utilized for its fine fiber. It is an Indian plant, found as high as 4,000 feet elevation.

Fatsia (*Aralia*) *papyrifera.*—Is planted for ornament, and seems perfectly hardy from San Francisco southward; as a source of the beautiful rice paper it might perhaps find more extensive use; it is the pith that is utilized.

Fourcroya longaeva.—Is a near relation of the Century plant (*Agave Americana*) from the high mountains of Mexico, at an elevation of 10,000 feet. It reaches gigantic size, with a stem 50 feet high, and a panicle of flowers about 40 feet. The fiber obtained from this, as well as from the perhaps less hardy *F. gigantea*, is very strong.

Stipa tenacissima.—A grass found in South Europe and North Africa, known as the Esparto, or Atocha. Its principal use of late has been for the manufacture of paper, but as it is content to live in driest spots near the desert, it may prove valuable as a forage plant. The plant deserves special trial.

Boemeria nivea (*the ramie*).—Although no machine, as yet, has solved the difficulty in regard to the preparation of this fiber plant, it is gratifying to know that it is perfectly hardy and well adapted to a greater part of California, as experiments in various parts of California have proved. As a paper plant it might perhaps find favor until the inventive genius of the Yankee has solved the difficult problem of constructing a ramie fiber machine.

Boemeria tenacissima.—Is, according to French and German seedsmen, the most valuable fiber plant, much superior to nivea; this, however, is contradicted by the report of the Agricultural Department, which says that the two are identical for all practical purposes.

Bamboos.—Under this head may be included all tree-like grasses, but especially those of a very hard and tough nature. Of the vast number of bamboos found in America, Africa, and Asia, we find some eighty different species mentioned as likely to succeed in sub-tropical countries. We shall mention a few, not because we think them little likely to succeed or of small importance; on the contrary, we subscribe fully to the eloquent plea of Ferd. v. Mueller, wherein he calls attention to their great usefulness for a multitude of purposes, and we believe that their importance can hardly be overestimated for treeless countries, where along the irrigating ditches they should be planted in every available spot. Our reason for naming but few is that the botanical names are generally not known in the countries where they are mostly cultivated, except in botanical gardens and their immediate surroundings. This is shown by the fact that even the government importations of last year are wanting in correct names. To give, therefore, a number of botanical names would be of little benefit to most people here, who have no means of procuring bamboo except by getting them from the natives and under the local name of the country, be it Mexico, South America, China, Japan, or India.

Arundinaria falcata.—Is the Ringal or Nigala bamboo; a native of the Himalaya Mountains, found at an elevation of from 3,500 to 10,000 feet; it rises to the height of 40 feet, with canes, however, of but 4 inches in diameter. The canes are strong and durable, and may be utilized for a variety of purposes. In the Garden of Economic Plants, in Berkeley, there is a plant of this species, raised from seed, but eighteen months old, that has, in three weeks, made canes nearly 6 feet long, and that without much moisture. This bamboo is, besides, perfectly hardy, even where it is beaten down with snow every winter. It is, furthermore, easy to increase by division and cuttings.

Dendrocalamus strictus.—Recommended as resisting great heat and cold; also for growing on drier ground than bamboos generally, attaining a height of 100 feet. Its strength and solidity make it very valuable. It is found in India, especially in Bengal. Seeds, donated by Baron Ferd. v. Mueller to the University Gardens, seem to require great heat to germinate.

Bambusa vulgaris.—Is the large unarmed bamboo of Bengal; grows to the height of 70 feet. It is, however, less hardy than any of the first named, though it will resist occasional frost, and might no doubt find many localities in the State to suit its requirements.

Phyllostachys nigra.—From China and Japan; is a very hardy, black-stemmed species, growing to the height of 25 feet. It is utilized for chairs and walking-sticks, as the canes are nearly solid.

In connection with these few named species, we must mention that in the Garden of Economic Plants, in Berkeley, are now growing five distinct species, derived from various sources, none of which we are able to determine. Three of these were imported by the Agricultural Department, and named *Bambusa metake*, *B. moso*, *B. tadake*. None of these are real botanical names, according to the best authority consulted on the subject (General Munro's Monograph of the Bamboos), except perhaps *B. metake*, which, however, does not answer to the specimen on hand. All these are doing well. A fourth kind is also introduced under the name *moso*, a slender species of rapid growth in Japan, utilized as greens, like asparagus. A fifth is a direct importation from Chooſoo, China, planted right from a tub into the garden. It sent forth shoots that in less than three weeks have grown 6 feet. This species may possibly be *Bambusa vulgaris*. Before leaving the bamboos, we desire to repeat that we have the greatest appreciation of the importance of the bamboo for California, and would be very grateful for any information and local experience in regard to these plants.

Jubæa spectabilis.—The Coquito of Chile is one of the hardiest palms. In its native home it is utilized for the production of a sirup for which the tree is regularly tapped. It is said to be very productive. The young plant resembles closely the date-palm.

Kentia sapida.—The Nika palm of New Zealand, Chatham Islands, is a beautiful palm yet hardly known in this country. The unexpanded flower-stalks are used as palm cabbage.

Plectocomia Himalayensi.—Is one of the hardiest rattan palms.

Salix purpurea.—From Europe and Asia; is one of the better Osier willows. This species, as well as the real Osier, *S. viminalis* and *S. triandra*, should be planted along watercourses, instead of the native more or less brittle species. Cuttings of these could, in proper season, be shipped with the greatest safety.

FOREST AND TIMBER TREES.

Quercus robur (the English or German oak).—One of the most valuable of all timber trees; deserves trial, not alone as an ornament shade tree, but for its timber. In Berkeley this tree has made the extraordinary growth of 4 feet the third season, outdoing all other oaks; and from Australia comes the report that it withstands even the fiery winds of the desert.

Quercus densiflora, or the chestnut oak of California, better known perhaps as tanbark oak. This beautiful tree, found associated with the redwood, is undergoing a wholesale slaughter, and maltreated as it is, it is no wonder that it never has attracted attention as a shade tree. In the redwoods this tree is seen to great disadvantage, but grown by itself it forms one of the handsomest trees in existence. Combining the pretty staminate flowers of the chestnut with fringed cups of the burr oak and the evergreen foliage, more like certain banksias in texture, it is one of the most remarkable and finest trees in California, well deserving a place in the garden, park, and avenue in preference to many most highly prized trees of cultivation. California possesses several very handsome oaks worthy of cultivation, as the black oak (*Quercus Kellogii*), the golden oak, or large live oak (*Quercus chrysolepis*); but as California trees perhaps are outside the scope of this report, we must satisfy ourselves by calling the attention to these few.

Quercus Aegilops, from South Europe.—Is a nearly evergreen oak, the fruit of which is available for dyeing and tanning; the cups are called valemia, while the unripe acorns are called camata; ripe, they may be eaten. The tree is, furthermore, a fine avenue tree.

Santalum album santalaceæ.—Is a small tree found in India, ascending to temperate regions in Mysore. The famous fragrant sandalwood is the product of this tree.

Santalum Preissianum.—Is an Australian sandalwood, called the native peach, the quandong or catunga by the aborigines. The fruit is edible, and can be reared in desert tracts.

Skimmia Wallichii.—A magnoliaceous tree from Indian mountains to the altitude of 5,000 feet, growing to the height of 100 feet, and yielding a valuable timber.

Acacia decurrens, var. *mollisima* (the black wattle of South Australia).—Is, in the bay counties, a well-known ornamental tree. Its great value for tanning is, however, but little known; as experiments in Ferd. von Mueller's laboratory show the artificially dried bark contains from 34 to 54 per cent. of tannin; the mercantile bark has, however, 10 per cent. more moisture; nevertheless, it is extremely rich, only 1¼ pounds of this bark being needed for 1 pound of leather, while 5 pounds of English oak are requisite. *A. mollissima* is one of the most rapid growing of the large growing acacias, and deserves planting, especially in dry, sandy, treeless regions. According to our experience it does not thrive in a tenacious, wet soil. The variety *dealbata*, or, as it is called by the colonists, the silver wattle, is distinguished by the ashy hue of the foliage and by maturing its seed in less than half the time of the *decurrens* proper. It is a fine tree for lumber, but is especially a very great heater, and most valuable as a source of fuel; on this account it deserves planting in treeless regions, aside from its beautiful appearance.

Acacia pycnantha, falcata and saligna.—Are small trees; very valuable for binding drift-sand and for tanning, specially *pycnantha*.

Acacia horrida, the Doom boom or kana doom of South Africa.—Is, as well as the Australian *A. armata*, available for hedges; the latter is quite hardy along the coast. Of all the numerous Australian acacias that grace our gardens, none deserves as much to be planted as the *A. melanoxylon*, known as the blackwood. This tree will, under favorable circumstances, reach 80 feet. The wood is most valuable for furniture, railway carriages, boat-building, casks, billiard-tables, and piano-fortes (for sound-boards and actions). The fine-grained wood is cut into veneers, takes a fine polish, and is considered almost equal to walnut. It is the best wood in Australia for bending under steam. Besides all these uses, the bark is available for tanning, air-dried bark containing from 15 per cent. to 28 per cent. of tannin. As the blackwood acacia is a rapid grower, and is hardy where the blue gum will thrive, and even withstands lower temperature, we have here one of the most desirable timber trees, that deserves planting on a larger scale just as much as the favorite eucalyptus. The blackwood acacia is not alone raised easily from seed, but can also be propagated from suckers, that appear in great abundance where a tree is cut down.

Acacia harpophylla, from Southern Queensland.—Is said to furnish a great deal of the bark for tanning, and a wood brown, hard, heavy, and elastic. It attains a height of 90 feet, preferring sand lands to the exclusion of other trees; wood pervaded by a violet odor.

Maples (Acer).—Among the numerous beautiful members of this genus the California species, *A. macrophyllum*, certainly deserves a place. Though not very tall, it forms a splendid shade tree for streets and avenues, and if taken proper care of is of rapid growth.

Acer platanoides, the so-called Norway maple, deserves trial, as well as the sycamore maple.

Acer Pseudo-Platanus.—Both thriving in the same climate as the English oak (*Quercus robur*), that has proved so well adapted to the coast region of this country. The well-known sugar maple; growth comparatively fast, and recommends itself to all old residents of the States east of the Rocky Mountains.

Albizzia julibrizzin, from Caucasus to Japan.—Is a favorite ornamental shade acacia in South Europe.

Amyris terebinthifolia (Brazil).—Has proved hardy in Victoria (Australia), and deserves, therefore, trial in California as an avenue tree.

Angophora intermedia.—Is the so-called apple tree of Australia, belonging to the myrtle family and a close ally of the eucalyptus, but a better shade tree than most of these.

Brachychiton acerifolium and populneum, Sterculiaceous trees of Australia.—Very ornamental both for foliage and flowers; the so-called flame tree, *acerifolium*, is perfectly hardy in the locality of Berkeley. Their growth is comparatively slow.

Buddleya Madagascariensis.—Of these ornamental trees one of the largest and prettiest may prove hardy in sheltered localities.

Castanopsis chrysophylla, the oak chestnut or Western chinquapin.—Is a native of California; though in the drier part of the State it only reaches the size of a dwarf shrub, it becomes a stately tree in the moist northern counties, reaching as much as 125 feet in height; like many other California trees yet to be mentioned, the oak chestnut deserves to be cultivated in the park and garden.

Casuarina, the she-oak horsetail pine (*Casuarineae*).—These singular trees can hardly be recommended as shade trees, but among them we find some of the most durable timber trees, most of them content to live in the barren coast as well as in the saline marshes and alkaline lands. If pollarded like willows, they will produce young shoots that cattle will live on.

C. equisetifolia, from East Africa, South Australia, South Asia, North Australia, Polynesia.—Attains as much as 150 feet in height; splendid for fuel, giving great heat and little ashes; timber tough; as many of this species will also live in saline ground, the yield of firewood from this tree has been estimated to be four times as great as any return from any tree in France. In India it grows on pure sand, and is much used for railway locomotives. The cost of rearing Casuarinas in India has been from £4 to £8, and the return after only eight years, £13 to £32.

C. suberosa, the erect she-oak of Southeast Australia.—Is of fine dense growth; endures the climate of the bay counties well; *quadrivalvis, glauca, torrulosa*, and others are valuable for their wood, and all deserve rearing in suitable localities.

Ceroxylon andicola.—The wax palm of New Granada, ascending the Andes to 11,000 feet elevation. One of the grandest and at the same time one of the hardiest of all palms reaching a maximum height of 180 feet; trunk exudes a wax, as much as 25 pounds being obtainable at one time.

Chamerops martiana.—A species of palm found in Nepal as high as 5,000 feet above the sea, forming a beautiful tree 50 feet high.

Cocos australis.—One of the hardiest of all palms, if not the hardiest, withstanding a temperature as low as 8° C.; therefore even hardier than the date palm: it is a native of Southern Brazil to Uruguay and the La Plata States. *Cyatay*, from the same region, together with *C. datil* from forests here, the latter producing date-like fruits.

Corynocarpus laevigatus.—The karaka of New Zealand, and the principal forest tree of the Chatham Islands, attaining a height of 60 feet. It is to be regretted that this beautiful tree cannot be recommended for general planting; it will, however, live in sheltered localities along the coast, for instance, in Santa Cruz, but will stand only a very slight degree of frost.

Drimys Winteri (*magnoliaceæ*).—Is the Canelo of Chile, sacred, under the name of Boighe, to the original inhabitants; reaches in river valleys a height of 60 feet. Wood never attacked by insects (according to Dr. Philippi).

Eucalyptus.—This extensive genus has found great favor in California, and planting of gum-tree forests is perhaps on the increase, especially the blue gum. *E. globulus*, though this, no doubt, is the fastest grower, it is by no means the most valuable. Of the extensive list mentioned by Ferd. von Mueller, we shall but mention a few, and refer any one who desires full information on this subject to the Eucalyptographia, just published by that author. By far the most important for California is the red gum, *E. rostrata*, which, as far as our knowledge goes, is but little known here. Strange as it is, the red gum sold in San Francisco and neighborhood is mostly *E. viminalis*, a valuable rapid grower, but in regard to the quality of wood greatly inferior to *rostrata*. This species, *rostrata*, will withstand more water inundation than many other eucalyptus, while the timber is one of the most durable and strongest for underground work. As it is naturally found in moist ground, with clay subsoil, it cannot be expected to thrive on the driest hills. It will, however, grow in saline soil. In Australia it is preferred to any other eucalyptus for railways and bridges, for ship-building, and, in fact, for any kind of durable work below or above water, as well as for underground work, and is second only to the famous Jarrah (*E. margintua*) in resisting the attack of the chelura and limnoria, the teredo, or even the white ants.

E. marginata.—Is the Jarrah or Yarrah of Western Australia; the wood of this tree is even more durable than teak, resisting the attacks of all borers known. On account of its color it is termed mahogany, and used for furniture, as it takes a beautiful polish. The Jarrah has not been found to be a fast grower as compared with *globulus* or *obliqua*, but infinitely faster than most other hard-wood trees, especially deciduous ones. Unfortunately, it is somewhat more tender than either. Of the other two species, specimens 4 and 5 feet high having been killed at the experimental grounds at Berkeley, the year before last, nevertheless others slightly sheltered escaped, and a specimen this year has survived the season unprotected. The great value of the timer makes it, however, most desirable that this tree should be tried in the southern part of the State, where there no doubt could be found localities warm enough for it. It makes the best wood on ironstone ranges, and, on the whole, the wood from the hills is darker, tougher, and heavier than that of the plains. The Yarrah is not of the tallest eucalyptus, but reaches, nevertheless, an enormous size; stems have been measured 80 feet to the first branch, and 32 feet in circumference 5 feet from the ground.

E. platyphylla.—Is a species from Queensland, said to thrive in exposed localities and produce very large leaves, 1½ feet long and 1 foot wide.

E. citriodora.—From Queensland, furnishes an excellent timber, and is pervaded with an easily extracted lemon-scented oil.

Fagus Cunninghami.—The Victorian and Tasmanian beech is a magnificent evergreen tree, not rarely 200 feet, furnishing excellent wood, the myrtle wood of the trade. Thriving only in rich damp soils, we can hardly expect to grow it where timber is most needed; but it would form a valuable addition to our shade trees in parks and large gardens.

Buxus sempervirens.—The tree box. As the boxwood is in constant demand and its supply in Asia Minor becoming scanty, it is to be hoped that some one will undertake the planting of it, which perhaps will be an investment slow in its returns, but likely to be a sure and profitable one in the end.

Ficus Sycamorus.—The sycamore fig-tree of the Orient; a splendid shade tree of enormous size; one of the trees in Cairo belonging to this species, legends connect with Christ, is still growing.

Flindersia Oxylayana.—The yellow wood of New South Wales and Queensland, as well as *F. australis*, are both valuable hard-wood timber trees, reaching as much as 150 feet in height.

Jacaranda mimosifolia.—From Brazil, furnishes the beautiful pallisandre wood; has proved hardy at Sydney, and will therefore probably thrive in sheltered localities in the southern counties.

Knightia excelsa.—Another proteaceous tree, the Rewa-reka of New Zealand, furnishing a most beautiful wood, specimens of which may be seen at the University cabinet collection.

Laurelia aromatica (*Laurineæ*).—A handsome evergreen tree, resembling the California bay-tree; is a native of Valdivia, Chili, where it produces a wood not attacked by insects. We believe that the seeds distributed by the Bulletin office under the name of Bayoto are of this tree.

PLANTS USEFUL ON TIDE OR STRONGLY ALKALINE LANDS.

Agiras majus, Myrsineæ:—A tree with habit of the mangrove, that might be uti d for consolidating muddy shores. For the same purpose, the *Aricenna officinalis*, a small tree belonging to the family *Myoporeæ*, and found in South Asia, New Zealand, and Victoria, is suggested.

Batis maritima, Halorageæ.—A small shrub, native of American shores, is well adapted for reclamation of tidal lands.

For the binding of drift sand no grass has, in Northern Europe, been found as valuable as the *Elymus arenarius*, preparing the land for shrubs and maritime trees.

Carex arenarius.—A sedge, is also to be recommended in this connection.

Frenela actonostrobus.—Is a cypress-like little tree or bush, flourishing in the Australian salt marshes.

Melaleuca parviflora and *trichostachya.*—Both shrubs of sea-coast of North Holland. They have been found hardy in Berkeley and should be tried in alkaline lands.

FORAGE PLANTS OF ESPECIAL ADAPTATION.

Anthistiria ciliata.—Is the well-known Kangaroo grass of Australia, South Asia, and Africa; deserves, as well as the *Anthistiria arenacea*, trial in California. The latter is especially thought very valuable in Australia as a fodder.

Atriplex nummularium, Chenopodiaceæ.—From Queensland through the desert tract to Victoria and South Australia. One of the tallest and most fattening of Australian salt bushes, and as Ferd. v. Mueller adds, highly recommendable for artificial rearing. He himself has sent seed of this and and a similar species, *A. vesicarium*, to California. Plants reared of this are growing on the experimental grounds in Berkeley. They seem well adapted to the climate there, and will be distributed the coming season to any one desirous of trying them. The young shoots grow readily as cuttings.

Kochia villosa, Salsolaceæ.—Known in Australia by the name of cotton bush on account of its hairiness, is a dwarf bush, resisting the extremes of the interior climate of Australia; deserving trial in our southern dry region, as it will give a very fair fodder.

Jacksonia cupulifera.—From West Australia. A leguminous plant, adapted for dry climates. Horses and cattle are very fond of the foliage. It grows to the size of a small tree.

Lotus tetragonolobus.—Another leguminous plant, native of South Europe. The pods are used as a substitute for asparagus. In Berkeley it has been found to withstand frost better than any other forage plant, keeping green all winter, and as it is succulent and tender, it might be of great value.

Medicago arborea (*Leguminosæ*).—A shrubby, yellow-flowering medick, said to promote the secretion of milk. Is a native of South Europe.

Neurachne Mitchelliana.—The Mulga grass. In the desert interior of East and Southeast Australia, recommended, together with *Neurachne Munroi*, for dry, sterile land. It is said to endure any amount of drought, but requiring heavy rains to start anew.

Pentzia virgata (*Compositæ*), of South Africa. A small bush, adapted for desert regions, offering a fair sheep's fodder. It spreads very rapidly by means of the young branches taking root.

The above list of plants likely to prove valuable in the arid regions of the Pacific coast could doubtless be greatly increased by a systematic effort to investigate the subject in the field as well as in literature, by competent persons, and a provision made by Congress to have this done through the Department of Agriculture would be of the greatest importance to agricultural progress in the arid regions. The countries bordering the Mediterranean and Australia would seem to be of the first importance as probable sources of valuable culture plants and methods adapted to arid climates; but the arid regions of Peru, Chili, and Bolivia, as well as the plateau countries of Asia, should not be forgotten.

In further illustration of the latent possibilities that may be developed by systematic experiment, we give the following extract from a report on the experimental field cultures in the grounds of the University of California, made in 1879, by Charles H. Dwinelle, lecturer on practical agriculture in that institution.

A SERIES OF FORAGE PLANTS FOR SUMMER AND AUTUMN.

Those having a climate similar to ours, and wishing for green feed from early spring to late autumn, will not go far amiss in following the list given below, which has been made up partly from the results of our experiments in the garden and partly from observation of the practices of farmers in the neighborhood.

1. Canary grass (*Phalaris canariensis*). The same that is used for birds. If sown early it will be 2 to 3 feet high in March or April.
2. Nepaul or Bald Barley (*Hordeum trifurcatum*). It should be sown on the best land available, in several plots, from the first rains until the middle of February. Cattle are exceedingly fond of it.
3. Bald or Naked Oats (*Avena nuda*). These make an immense amount of leafy fodder, if cut in bloom.

4. Indian Corn (*Zea mays*).—The smaller varieties from the north mature earlier than the southern kinds. Of field corns the small Canada and King Philip are good, and the Minnesota and Red River sweet corns will mature with wonderful rapidity. For late cutting some of the so-called evergreen kinds should be added. Plant the first as soon as frosts are over, and plant two or three times at intervals f ten days or two weeks.

5. Sorghums (*Sorghum vulgare*). If the following sorghums are sown about April 1 they will come in, one after another, during the latter part of summer and autumn: Chinese sugar cane, Egyptian corn, evergreen broom corn, amber cane, imphee.

The above series is recommended for the coast climate of Middle California, and especially with the addition of alfalfa would afford the dairyman green feed throughout the season in which, at present, "*dry pasture*" is so largely resorted to. Since the above was written, a highly important addition to the drought-resisting grasses adapted to the climate has been found in the sorghum halapense, variously known as Green Valley grass, Johnson grass, false Guinea grass, &c. Many others are on trial, and there can be no doubt that satisfactory series of this kind can be found for a large part of the region without summer rains, even independently of irrigation.—E. W. H.

INSECT PESTS.

(R. H. FURNAS.)

That a region of country so highly favored, especially in the matter of climate, should be exempt from serious ills could not be expected. Natural conditions render California particularly liable to the introduction and propagation of insect pests. To secure success in fruit-growing "eternal vigilance" must be the guiding watchword of each and all engaged in this calling. While those interested have doubtless been slow in awakening to the true condition of affairs, there is now a healthy, vigorous movement in the right direction, which will, if followed up, end in victory to fruit culturists. The chief executive officer of the State horticultural organization, Matthew Cooke, has shown himself to be an expert practical entomologist, together with thorough business qualifications, which cannot fail to accomplish the desired ends. His investigation leads him to say:

> It should be stated that in the beginning of the fruit-growing industry, and until within ten years, the remarkable freedom of California fruits from insect pests was often commented upon. It is chiefly since railroad communication has rendered possible the pernicious system of returning fruit boxes, that the invasion of insects has become more general.
>
> The aggregate amount of damage to orchard property in California by depreciation in value, caused by spread of insects injurious to fruit and fruit trees, within the last five years, cannot be accurately stated, as there are no statistics to refer to; but it can be safely estimated at $2,000,000. It is not claimed that this amount of actual damage was done, but fruit-growers were ignorant of any reliable remedy, thus causing a greater depreciation in value than was necessary. The damage to apple, pear, and quince crops, by codlin moth and scale insects, since 1877, is at least 50 per cent. of the whole crops produced.

If to the above is added the damage to plum and orange crops by scale insects, by red spider (mite) on almond and cherry crops, the loss in currant orchards by borers, and the damage by caterpillars, squash bugs, &c., to fruit and foliage, not more than 33⅓ per cent. of what the orchards are capable of producing can be classed as choice marketable fruit.

Inquiries concerning diseases of trees and insect pests not heretofore observed in orchards are frequent, all tending to prove that the prospects of fruit-growers in this State are not encouraging if active measures are not adopted for the extermination of insect pests.

> Query. Can our orchards be protected from the ravages of insect pests?
>
> Answer. Yes, undoubtedly, by a united warfare for the destruction of insect pests by all persons owning fruit trees, and other varieties of trees infested by noxious insects.

Mr. Cooke's treatise on insects injurious to fruit and fruit trees in California, and remedies recommended for their extermination, lately published under authority of the State Board of Horticulture, is doing much towards rousing fruit-growers into activity. It is concise, practical, and so sparing of technical and scientific terms as to adapt itself peculiarly to the masses.

My own observation leads to the conclusion that more insect ills are found in low lands, valleys and plains, than in more elevated regions, such as the foot-hills.

THE PHYLLOXERA IN CALIFORNIA.

By E. W. Hilgard.

The presence in California of this formidable enemy of the vine has been known for nearly nine years; but it is only within the last two years that a definite knowledge of the extent and history of the invasion has been gained, as a result of the creation of the State Viticultural Commission.

It appears that its presence was first definitely recognized in August, 1873, by a committee of the Viticultural Club of Sonoma, in a vineyard situated 2 miles north of the town of Sonoma.

Specimens of the insect were sent to Professor Riley, and identified by him. The area then invaded was stated to be about 8 miles up and down the valley, and about 2 miles across.

It was then attempted to rouse the vine-growers into active precautionary and repressive measures, and legislative action was also sought. But the increasingly depressed condition of the interest, as well as an unwillingness to look the danger in the face, and in acknowledging it to injure the value of vineyards in the valley, prevented any serious or co operative measures being taken. Such were, however, attempted in the large and valuable vineyard of the Buena Vista Company, of which the report of Mr. H. Appleton, published in the first annual report of the State Viticultural Commission, gives the following account:

> A vineyard of about 1,000 vines was planted in 1834–'35 and was watered every year. In 1850 and 1852 the vineyards was largely increased, and the system of irrigation was stopped. In 1857 about 200,000 vines were set out, and in 1858 100 acres were put in vines, 680 vines to the acre. Again, in 1860, 50 acres were laid out. In 1862, Col. A. Haraszthy planted 70,000 European vines, and it was among these vines the disease increased most rapidly.
>
> In the spring of 1863 the Beuna Vista Company was incorporated, and in the spring of 1864 that company planted 100,000 vines. As early as 1860, decayed and dying vines were noticed in the vineyard, and they were taken up and others planted in their places. An examination was made to discover the cause of disease in these vines, and it was attributed to alkali water, which was found a few feet beneath the surface. The roots were decayed. No microscopic examination of these roots was made. Vines died from time to time, showing short growth, small and colorless grapes, early yellow leaves; in fact, all the symptoms of vines dying from the vine pest were observed. In 1868 about three acres of diseased vines (planted in 1850) were taken up, and others planted in their places. They grew well, showing little signs of decay until they were four years old, at which time the phylloxera committee of the Viticultural Club found the phylloxera on several vines. During the past five years the Buena Vista Company have inaugurated a system of examinations in the endeavor to destroy the phylloxera. These experiments were made in most cases very thoroughly, extending over from ten to one thousand five hundred vines, at a cost of $2,500 in labor and material to the company. The most of these experiments were useless, and none of them gave general satisfaction in their results.
>
> Bisulphide of carbon was thoroughly used for a number of years. In 1875 and '76, four hundred vines were put under the influence of this chemical, forced under ground by a hollow tube and plunger, with three or four insertions around each vine. Experiments with bisulphide of carbon have been followed up to the present time; as many as one thousand five hundred vines were under its influence at one time. The company also tried coal tar, coal oil, coal tar and gas lime mixed, carbolic acid, concentrated glycerine, bisulphide of carbon and manure mixed, sulphuric acid and water, J. O. Weatherby's remedy, guano, Hoffman's remedy, Dr. E. J. Fraser's remedy,

> liquid from tanned skins, liquid from cow and other manure, Descuhes rohart, whale oil and copperas, &c.
>
> Planting corn near diseased vines was tried, and the fact was established that the phylloxera was found in large quantities on the roots of the corn, and the vines seemed to recuperate under its influence.
>
> Examinations were made, and the insect found on the roots 6 feet under ground. Vines were taken up, and the cuttings planted died the next year, and were followed by rooted vines, which showed signs of disease when one year old.
>
> A. S. Edwards' vineyard (commonly known as Butler's vineyard) of 80 acres, had dead vines in it during 1871–'72, and in 1873 the phylloxera committee found the insect in a number of places. These infected vines were heavily manured for a number of years without staying the ravages of the insect. In 1876 the whole of this vineyard was abandoned, and has not been plowed or pruned since.
>
> It was noticed that there was a check in the death of vines after it was abandoned. It is thought by many that this was caused by the hard ground preventing the insect spreading to healthy vines. Many costly experiments have been tried in different parts of the valley, but as they did not accomplish the object desired, I need not mention them here.

Data concerning the Orleans vineyard, located in the foot-hills of the Coast Range, west of Woodland, Yolo County, seem to indicate that there, also, the phylloxera was introduced with European vines, about the same date that its ravages were first noticed at the Buena Vista vineyard in Sonoma.

The writer visited the latter valley in October, 1875, and found the manifestations of the pest precisely the same as described elsewhere. One vineyard was almost completely destroyed, and several miles each way from the town of Sonoma the beginning of the attack was visible in low basin-shaped spots, forming depressions in the luxuriant mass of foliage. Within the ever-widening circles of destruction many vines were entirely dead, while others (and among these oftentimes those earliest attacked) maintained a feeble growth, the roots of these being mostly abandoned by the insect. The latter was found in the greatest abundance, not within the visible circle of damage, but from 10 to 15 feet outside of its extreme margin. Here the outlying white rootlets were fairly clustered with the yellow brood, even at that late season (end of October).

In the hope of drawing attention to the seriousness of the danger, a "bulletin" was shortly after issued by me from the University press, in which I gave a succinct account of the life history of the phylloxera (as then known), of the damage caused by it in Europe, its fearfully rapid progress, and of the efforts thus far made to check it. But little interest, however, was taken in the subject, even in the Sonoma Valley.

Efforts made to secure legislative aid towards the suppression of the pest failed of success. To my surprise, I could hear but little about the phylloxera for a year or two afterward; nor could I obtain any definite information regarding its progress by correspondence, my University duties preventing a personal visit at the time. It appears that the cause of this silence was twofold: First, the great depression of the wine interest, causing a feeling that the culture might as well be given up for something more profitable; second, that although the spread of the insect had continued steadily, yet it was so much slower than had been the case in Europe, and than had been anticipated and predicted by me, that a great deal of incredulity and of wild speculation as to the cause of the dying out of the vines had become current. It was not until the return of brighter prospects for vine-growing, owing to the diminished production in Europe, and to a better appreciation of California wines in the market, that serious attention was at last given to the phylloxera, and the policy of "hushing up" was replaced by discussion as to the means of prevention and relief.

The situation in the Sonoma Valley in 1879 may be summed up as follows: The ravages of the enemy have become manifest in a greater or less degree, from about 6½ miles above Sonoma town to the lower end of the valley, a length of 10 or 11 miles in all. Within these limits large tracts have been completely destroyed, the vines having been uprooted and grain sown instead for several years. It is difficult to ascertain the total area of vineyard that has disappeared, but it counts many hundreds of acres. On a still larger area, probably, the condition of the vines has become such as to render them unprofitable, so that they are being pulled up and used for firewood in the wineries. So far no material difference in respect to the resistance of the several varieties have been reported, all those grown being of the type of the European vine (*vitis vinifera*), grown on its own or kindred stock. The mission vine, naturalized for over a century in California, is at least as badly attacked as is the Riesling, Zinfindel, Rose of Peru, or any other grown.

Amid the general devastation nevertheless there were some exceptions—Green Islands, apparently of healthy vines, in good bearing, yet surrounded on all sides by defunct vineyards. This was even the case in the vineyard which first succumbed, where, nevertheless, some of the original vines still remain, apparently in good condition. A close study of these exceptions could not fail to lead to highly valuable results. In general, it appears that great care of the vines, good tillage, and manuring have been practiced in all these cases; but there are many others in which no amount of care or manuring has seemed to possess any perceptible efficacy, and where the destruction has been as swift as in the doomed vineyards of France.

Whatever may be the true explanation of these remarkable exceptions, the general fact remains that in four years the insect has spread no more than about 2½ miles up the valley, from a point of great virulence, notwithstanding the fact that this is the prevalent direction of the summer winds. The natural inference from this fact would seem to be that from some climatic cause the phylloxera in California does not develop largely into the winged form, which evidently mediates its rapid progress in Europe; and that its progress is here chiefly dependent upon the transportation or migration of the wingless forms.

The observations made since 1879 seem to confirm the rarity of the winged form in California. It has not thus far been caught abroad at all, although traps of sticky papers have been numerously hung among infested vines. The only samples so far seen in California have been raised in jars from infested roots. It may be added, that well-authenticated cases of the "winter egg" are also thus far lacking. Observations made during the present winter at the University have shown the live insect, in a discolored, quiescent state, to persist throughout the season near the crown of the roots.

Whatever may be the true explanation of the slow progress of the phylloxera in California, it is a fact of the greatest moment; for it reduces greatly the direct damage as well as the danger of spread to uninfested districts, and so justifies the somewhat severe sanitary regulations imposed by the State board of viticulture, such as in France have been found unavailing on account of the prevalence of the winged form. Meanwhile the investigations which have been made under the joint auspices of the University and of the board of viticulture have shown that the insect prevails over a much wider area than was originally suspected. The invasion is more or less general in the valleys of Sonoma and Napa (in the latter up to Yountville, and in the tributary valleys; also at one point near Saint Helena); at several points in Solano, Yolo, Placer, and Eldorado; not definitely ascertained in Sacramento, but again in one locality near Stockton; also in several localities near San José; and in the experimental vineyard at Berkeley, where it has only lately been discovered and has not been extirpated for the sake of allowing of some observations not easily made elsewhere.

The invasion thus covers a broad belt reaching from the coast range to the foot-hills of the Sierra Nevada; and were its progress as rapid and irresistible as has been the case in France, it might be inferred that the existing vineyards of non-resistent vines are doomed. But with the natural disabilities under which the insect evidently labors in California, and with the close vigilance now exercised by the majority of grape growers, it is probable that the pest can be kept practically within its present limits. It would also seem that it is easier to keep infested vineyards in profitable bearing here than elsewhere, by the joint use of insecticides and manures. Supposing that all the unprotected vineyards at present planted will ultimately succumb, this will be a hardship for certain localities; but the aggregate loss thus incurred will be small compared with the area likely to be planted within the next few years, and protected against the phylloxera by means of grafting or submersion. Thus on the whole, while the agitation and investigation of the subject has shown the existing invasion to be wider than any one had anticipated, yet the accurate knowledge of the danger has carried with it also the confidence that it can be conquered or prevented, and has placed the knowledge of the means to that end within reach of all. It has brought about the establishment of a manufactory of that most energetic of insecticides, the carbon bisulphide, reducing its retail cost to one-fourth, and allowing of its use not only against the phylloxera, but also against the larger pest of the farmer, the ground squirrel and gopher. Attention has also thus been more prominently drawn to the insect enemies of other fruits and crops, and by united action, backed by a wise compulsory law, there is every prospect of nipping many of these growing evils in the bud.

ACTION TAKEN REGARDING INSECT PESTS IN CALIFORNIA.

The several acts passed by the legislature of California for the protection of the viticultural and horticultural interest against insect pests, being the most thorough provisions thus far made within the United States, are here given in full as a matter of general interest:

CHAPTER LXII.

AN ACT for the promotion of the viticultural industries of the State.—(Approved April 15, 1880.)

The people of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. There shall be appointed by the governor a board of State Viticultural Commissioners to consist of nine members, two to be appointed from the State at large, and one to be appointed from each of the several viticultural districts, which shall be constituted as follows:

First. The Sonoma district, which shall include the counties of Sonoma, Marin, Lake, Mendocino, Humboldt, Del Norte, Trinity, and Siskiyou.

Second. The Napa district, which shall include the counties of Napa, Solano, and Contra Costa.

Third. The San Francisco district, which shall include the city and county of San Francisco, and the counties of San Mateo, Alameda, Santa Clara, Santa Cruz, San Benito, and Monterey.

Fourth. The Los Angeles district, which shall include the counties of Los Angeles, Ventura, Santa Barbara, San Luis Obispo, San Bernardino, and San Diego.

Fifth. The Sacramento district, which shall include the counties of Sacramento, Yolo, Sutter, Colusa, Butte, Tehama, and Shasta.

Sixth. The San Joaquin district, which shall include the counties of San Joaquin, Stanislaus, Merced, Fresno, Tulare, and Kern.

Seventh. The El Dorado district, which shall include the counties of El Dorado, Amador, Calaveras, Tuolumne, Mariposa, Placer, Nevada, Yuba, Sierra, Plumas, Lassen, Modoc, Alpine, Mono, and Inyo.

SEC. 2. The commissioners, excepting the two appointed from the State at large, shall be residents of the districts from which they are appointed, and shall be specially qualified by practical experience and study in connection with the industries dependent upon the culture of the grapevine in this State. They shall each hold office for the term of four years, excepting that, of the nine first appointed, four to be determined by lot, shall retire at the end of two years, when their successors shall be appointed by the governor.

SEC. 3. The board shall elect from among their own number a president, a vice-president, and a treasurer, and they shall appoint a secretary, who shall not be one of their number, and whose salary shall not exceed one hundred dollars per month. And the board shall determine and fix the amount of bonds that shall be given by the treasurer and secretary for the faithful performance of their duties.

SEC. 4. It shall be the duty of the board to meet semi-annually to consult and to adopt such measures as may best promote the progress of the viticultural industries of the State. It shall be their duty to select and appoint competent and qualified persons to deliver at least one lecture each year, in each of the viticultural districts named in section one of this act, for the purpose of illustrating practical viticultural topics, and imparting instruction in methods of culture, pruning, fertilizing, fermenting, distilling and rectifying, treating diseases of the vine, raising, drying, &c., for the better instruction of the people interested therein, as the requirements of each district may show to be necessary and important, and to disseminate all such useful knowledge relating to viticulture, by printed documents or correspondence, as may be within their power to do. The board shall devote especial attention to the study of the phylloxera and other diseases of the vine, and shall make such recommendations in their semi-annual reports as they may deem best for the protection of vineyards.

SEC. 5. The commissioners constituting the board shall serve without compensation and shall be allowed only their actual transportation expenses to and from their places of residence when attending the semi-annual meetings of the board.

SEC. 6. The office of the board shall be in the city of San Francisco, and shall be kept open to the public, subject to the rules of the board, every day, excepting legal holidays, and shall be in charge of the secretary during the absence of the board.

SEC. 7. It shall be the duty of the secretary to attend all regular meetings of the board, and to preserve records of proceedings and correspondence; to collect books, pamphlets, periodicals, and other documents containing valuable information relating to viticulture, and to preserve the same, to collect statistics and other information showing the actual condition and progress of viticulture in this State, and elsewhere; to collect information concerning lands suitable for viticulture, and to impart to the public, upon proper demand being made, information concerning the localities of such lands, prices, cost of cultivation, and means of transportation; *provided*, that he shall receive no fees for such services; to correspond with agricultural and viticultural societies, colleges and schools of agriculture, and other persons and bodies political or private, and disseminate information printed or otherwise as he may be directed by the board of commissioners, and to prepare, as required by the board, semi-annual report for publication.

SEC. 8. And for the further promotion of viticultural interests, it shall be the duty of the board of regents of the University of California to provide special instruction to be given by the agricultural department of the University in the arts and sciences pertaining to viticulture, the theory and practice of fermentation, distillation, and rectification, and the management of cellars, to be illustrated by practical experiment with appropriate apparatus; also, to direct the professor of agriculture or his assistant to make personal examinations and reports upon the different sections of the State adapted to viticulture; to examine and report upon the woods of the State procurable for cooperage, and the best methods of treating the same; and to make analysis of soils, wines, brandies, and grapes at the proper request of citizens of the State; also to prepare a comprehensive analysis of the various wines and spirits produced from grapes, showing their alcoholic strength and other properties, and especially any deleterious adulterations that may be discovered. The regents shall also cause to be prepared, printed, and distributed to the public quarterly reports of the professor in charge of this work, relating to experiments undertaken, scientific discoveries, the progress and treatment of the phylloxera and other diseases of the vine, and such other useful information as may be given for the better instructions of viticulturists.

SEC. 9. The board of regents of the Univetsity shall be authorized to receive and accept donations of lands suitable for experimental vineyards and stations, and shall submit in their next annual report an economical plan for conducting such vineyards, and for the propagation and distribution of specimens of all known and valuable varieties of grapevines.

SEC. 10. There is hereby appropriated, for the purpose mentioned in this act, the sum of seven thousand dollars, to be apportioned as follows: For the necessary and contingent expenses of the board of State viticultural commissioners, four thousand dollars, and for the University of California three thousand dollars; and the State controller shall draw his warrants upon the State treasurer in favor of the treasurer of the said board of State viticultural commissioners and of the University of California, for amounts of four thousand and three thousand dollars respectively, as hereby appropriated, upon proper demand being made for the same; *provided* that the said board of State viticultural commissioners shall, in the month of December, submit to the governor annual statements, duly verified by the oaths of the presidents and treasurer and attested by the secretary of said board, showing in detail the manner in which moneys received from the State have been expended, and also the amount remaining unexpeneded, together with an estimate of expenses for the ensuing year, beginning on the first day of July next thereafter.

SEC. 11. This act shall take effect and be in force from and after its passage.

CHAPTER LI.

AN ACT to define and enlarge the duties and powers of the board of State viticultural commissioners and to authorize the appointment of certain officers, and to protect the interests of horticulture and viticulture. (*Approved March* 4, 1881.)

The people of the State of California, represented in senate and assembly, do enact as follows:

SECTION 1. The board of State viticultural commissioners, in addition to the duties and powers provided for by the act entitled "An act for the promotion of viticultural industries of the State," approved April fifteenth, eighteen hundred and eighty, shall, in respect to diseases of grapevines and vine pests, constitute a board of health. It shall, in addition to laboratory work, cause practical experiments to be made to determine or demonstrate the utility of known and new remedies against such diseases and pests.

SEC. 2. The board shall elect of their own number, or appoint from without their number, a competent person to serve as chief executive viticultural officer, who shall perform also the duties of viticultural health officer, under direction of said board, and subject to removal from such office at any time by the board.

SEC. 3. The viticultural health officer shall have power, subject to the approval of the board, to prevent the spread of vine diseases and vine pests, by declaring and enforcing rules and regulations in the nature of quarantine; to govern the manner of, restrain, or prohibit the importation into the State, and the distribution and disposal within the State, of all vines, vine cuttings, débris of vineyards, empty fruit boxes, or other material on or by which the contagion of vine diseases and germs of vine pests may be introduced into the State, or transported from place to place within the State; to declare and enforce regulations approved by the board for the disinfection of vines, vine cuttings, vineyard débris, empty fruit boxes, and other suspected material dangerous to vineyards, while in transit, or about to be distributed or transported into or within the State; to classify the vineyards and viticultural regions of the State according to the degree of health or vine disease prevailing therein, and to change the same as circumstances may require to be done, subjecting each class to such varying rules and regulations, respecting the introduction or transportation of vines, vine cuttings, and other material liable to spread contagion of diseases among vines, as may, in the opinion of the board become necessary and expedient for the preservation of vineyards. Such rules and regulations shall be circulated in printed form by the board among the vine growers and fruit dealers of the State, shall be published at least thirty days in two daily newspapers of general circulation in the State, not of the same city or county, and shall be posted in a conspicuous place at the county seat of each county affected by their provisions.

SEC. 4. The viticultural health officer may appoint local resident inspectors in any and all of the viticultural regions of the State, whose duties shall be to report to him concerning the health of grapevines, the progress of vine diseases and pests, and all violations of the rules and regulations of the board; to certify to the proper disinfection of vines, vine cuttings, empty fruit boxes, and other transportable articles required by the board to be disinfected before transportation or while in transit, or after delivery at any point of destination, the methods of disinfection to be determined and approved by the health officer and the board; to seize upon and destroy all vines, vine cuttings, débris of vineyards, empty fruit boxes, and other material liable to spread contagion, which may be found in transit, or delivered after transportation, not certified to as required by the board: *Provided*, That the same may be exempt from such destruction if the cost of disinfection by such inspector shall be provided for by the owner or agent in charge thereof, as may be prescribed for such cases of negligence, carelessness, or violation of quarantine rules, and to keep a record of all proceedings as such inspectors: *Provided*, That there shall be no compensation for such services of inspection excepting a fee not to exceed one dollar for each certificate of disinfection, in case of compliance with quarantine regulations, and not to exceed five dollars for each certificate of disinfection after seizure for non-compliance: *Provided, however*, Such inspection may be employed at the option of the owner of property requiring disinfection to disinfect the same. All vines, or other articles absolutely prohibited of importation, or transportation, may be promptly destroyed by any inspector discovering the same transported or in transit, in violation of regulations, and the cost of such seizure, together with a fee of ten dollars, shall be paid to such inspector out of any fine that may be collected from the party or parties guilty of such violation. Willful violation of the quarantine regulations of the board shall be considered a misdemeanor, and punishable by a fine of not less than twenty-five nor more than one hundred dollars. Whenever required for the convenience of vine or fruit growers or fruit dealers, a resident inspector shall be appointed upon petition of any three neighboring vine or fruit growers, or dealers in grapes, to reside in their vicinity, if not already provided for; and there shall be not less than two inspectors appointed for each county which is subject to such quarantine regulations, and they shall each be subject to removal at the will of the viticultural health officer, if incompetent, or they fail to perform their duties, or are unreasonably distasteful to vine growers and grape dealers.

SEC. 5. It shall be also the duty of the chief executive viticultural officer to personally visit, examine, and report upon the several viticultural regions of the State; to prepare documents for publication, as required by the board, relating to any and all branches of viticultural industry, including treatises for the instruction of the public; to supervise the preparation of reports for publication, and especially report upon the practicability and means of eradicating diseases from vineyards, and to superintend experiments with known and new remedies.

SEC. 6. All printing heretofore ordered by the board shall be paid for out of the appropriation heretofore made for its use. All printing required hereafter shall be done by the State printer.

SEC. 7. The salary of the chief executive viticultural officer shall be fixed by the board, not to exceed one hundred and fifty dollars per month, for services while engaged as such officer, and his actual traveling expenses shall be allowed, not to exceed five hundred dollars per annum.

SEC. 8. The board of State viticultural commissioners shall also appoint an officer, who shall be especially qualified by practical experience in horticulture for the duties of his office, to perform similar duties respecting the protection of fruit and fruit-trees as are provided for in this act in reference to grapevines, with like power; and the salary and traveling expenses of such officer shall be fixed by the said board at the same amount provided for in the case of the chief executive viticultural officer; and the said board shall have power to establish such quarantine rules and regulations as are required for the protection of fruit and fruit trees from the spread of insect pests.

SEC. 9. There is hereby appropriated for the use of the board of State viticultural commissioners, as set forth in this act, and in the act providing for its organization, out of any moneys in the State treasury not otherwise appropriated, the sum of ten thousand dollars for the year commencing July first, eighteen hundred and eighty-one, and ten thousand dollars for the year commencing July first, eighteen hundred and eighty-two; and the State controller will draw his warrants upon the State treasurer in favor of the treasurer of the said board for the said sum, or any part thereof, when they become available, upon proper demand being made for the same by said board: *Provided*, That no claim shall be paid out of said appropriation until the same shall have been presented to and approved by the State board of examiners.

SEC. 10. This act shall take effect and be in force from and after its passage.

CHAPTER LXXV.

AN ACT to protect and promote the horticultural interests of the State.

The people of the State of California, represented in senate and assembly, do enact as follows:

SECTION 1. Whenever a petition is presented to the board of supervisors of any county, and signed by five or more persons who are resident freeholders and possessors of an orchard or both, stating that certain or all orchards, or nurseries, or trees of any variety, are infected with scale bug, codling moth, or other insects that are destructive to trees, and praying that a commission be appointed by them, whose duty it shall be to supervise their destruction, as hereinafter provided, the board of supervisors shall, within twenty days thereafter, select three commissioners for the county, to be known as a county board of horticultural commissioners. The board of supervisors may fill any vacancy that may occur in said commission by death, resignation, or otherwise, and appoint one commissioner each year, one month or thereabouts previous to the expiration of the term of office of any member of said commission. The said commissioners shall serve for a period of three years from the date of their appointment, except the commissioners first appointed, one of whom shall serve for one year, one of whom shall serve for two years, and one of whom shall serve for three years, from the date of appointment. The commissioners first appointed shall themselves decide, by lot or otherwise, who shall serve for one year, who two years, and who three years, and shall notify the board of supervisors of the result of their choice.

SEC. 2. It shall be the duty of the county board of horticultural commissioners in each county, whenever they shall be informed by complaint of any persons residing in such county that an orchard, or nursery, or trees, or any fruit-packing house, storeroom, salesroom, or any other place in their jurisdiction, is infested with scale bug, codling moth, red spider, or other noxious insects liable to spread contagion dangerous to the trees or fruit of complainant, or their eggs or larvæ injurious to fruit or fruit trees, they shall cause an inspection to be made of the said premises, and if found infected they shall notify the owner or owners, or the person or persons in charge or possession of the said trees or places, as aforesaid, that the same are infected with said insects or any of them, or their eggs or larvae, and shall require such person or persons to disinfect the same within a certain time to be specified. If within such specified time such disinfection has not been accomplished, the said person or persons shall be required to make application of such treatment for the purpose of destroying them as said commissioners shall prescribe. Said notices may be served upon the person or persons owning or having charge or possession of such infested trees, or places, or articles as aforesaid, by any commissioner, or by any person deputed by the said commissioner for that purpose, or they may be served in the same manner as a summons in a civil action. If the owner or owners, or the person or persons in charge or possession of any orchard, or nursery, or trees, or places, or articles infested with said insects, or any of them, or their larvae or eggs, after having been notified as above to make application of treatment as directed, shall fail, neglect, or refuse so to do, he or they shall be deemed guilty of maintaining a public nuisance, and any such orchards, nurseries, trees, or places, or articles thus infested shall be adjudged and the same is hereby declared a public nuisance, and may be proceeded against as such. If found guilty, the court shall direct the aforesaid county board of horticultural commissioners to abate the nuisance. The expenses thus incurred shall be a lien upon the real property of the defendant.

SEC. 3. Said county board of horticultural commissioners shall have power to divide the county into districts, and to appoint a local inspector for each of said districts. The duties of such local inspectors shall be prescribed by said county board.

SEC. 4. It shall be the duty of said county board of commissioners to keep a record of their officers' doings, and to make a report to the board of State viticultural commissioners on or before the first day of November of each year, who shall incorporate the same in their annual reports.

SEC. 5. It shall be the duty of the commissioners at large, appointed by the board of State viticultural commissioners for such purpose, to recommend, consult, and act with the county board of commissioners in their respective counties, as to the most efficacious treatment to be adopted for the extermination of the aforesaid insects, or larvae, or eggs thereof, and to attend to such other duties as may be necessary to accomplish or carry out the full intent and meaning of this act.

SEC. 6. Each county commissioner and local inspector may be paid five dollars for each day actually engaged in the performance of his duties under this act, payable out of the county treasury of his county: *Provided*, That no more shall be paid for such service than shall be determined by resolution of the board of supervisors of the county for services actually and necessarily rendered.

SEC. 7. Each of said commissioners may select one or more persons, without pay, to assist him in the discharge of his duties, as he may deem necessary.

SEC. 8. If any county board of commissioners after having received complaint in writing as provided for in section two of this act, shall fail to perform the duties of their office, as required by this act, they may be removed from office by the board of supervisors, and the vacancy thus formed shall be filled in the same manner as provided for in this act.

SEC. 9. Nothing in this act shall be construed so as to affect vineyards or their products.

SEC. 10. This act shall take effect immediately.

The following extracts from the proceedings of the convention of fruit growers and nurserymen, held at Sacramento in December, 1881, convey some important information regarding the state of affairs that occasioned the above legislation, and the measures adopted for the repression of insect pests in the State of California.

Matthew Cooke, chief executive horticultural officer, in an address delivered on the occasion, made these statements:

INVASION OF INSECT PESTS.—From the time that Smith, Hollister, and others planted the fruit orchards on the banks of the American River, until 1875, fruit growers seemingly entertained the opinion that their industry in this State was absolutely safe from the invasion of insect pests, such as were known in orchards in States east of the Rocky Mountains. Alas! they were mistaken. In the summer of 1875, the codlin moth, *Carpocapsa pomonella*, made its appearance in the vicinity of Sacramento, and in the same careless manner in which it was introduced it was allowed to spread. No precaution of any kind was taken to destroy the pest; but, as it were, every facility offered for its spread throughout the fruit-growing districts, especially by the introduction of the package known as the return box. The adoption of this package was a serious mistake, so far as the spreading of this pest was concerned. This I say without fear of contradiction. The codlin moth was introduced into this State in less than five barrels of apples in the fall of 1873, and was noticeable in orchards in the vicinity of Sacramento in 1875, and can be found in orchards in the following named counties at the present time: Butte, Sutter, Yuba, Colusa, Nevada, Placer, El Dorado, Amador, Sacramento, Yolo, Solano, Napa, Sonoma, Lake, Mendocino, Marin, Contra Costa, Alameda, San Joaquin, Santa Clara, San Mateo, Tuolumne, Calaveras, Tulare, Kern, Los Angeles, and in some other counties.

Of the twenty-six counties named, county boards of horticultural commissioners have been appointed in eleven of them. It is unnecessary for me to speak of the amount of damage done to the fruit crop, especially apple and pear, by this pest. Unfortunately it is too well known by all parties interested in fruit growing and the various branches of business connected with that industry. And in order to impress upon your minds the necessity of an immediate warfare for the extermination of this pest, I will refer to reports received from some members of county boards of horticultural commissioners. One of the commissioners states in my report: "I have visited all the orchards in his district; three-fourths of the entire crop of this season has been destroyed by codlin moths. But I can say, to enforce the laws, it would take an army of officers. The fruit grower may be induced to put on the barrels, but to get them examined, as required by the rules, would be an impossibility." This may be taken as a purport of the report from two counties.

Since the appearance of the codlin moth in 1875, orchards, in several sections of the States, have been infested by various species of scale insects. In the citrus groves of Los Angeles we find the so-called red scale, *Aspidiotus aurantii.* It was thought, until this season, that the pest was confined to Los Angeles County, but at present it can be found as far north as Marysville.

The black scale, *Lecanium oleæ*, is to be found on nearly every variety of citrus and deciduous fruit tree in the southern counties and in Central California.

The soft orange scale, *Lecanium hesperidum*, is found on citrus trees throughout the State.

The common apple scale—*Mtilaspis pomicorticis*—is found in Central California, especially in the bay counties and Santa Cruz.

The scale—*Aspidiotus rapax*—is found in some of the bay counties, Santa Cruz, and some of the southern counties, especially Los Angeles.

The so-called San José scale (*Aspidiotus perniciosus*) has infested nearly every variety of deciduous fruit tree in Santa Clara County, and can be found in some orchards in San Joaquin, Yolo, and Solano Counties.

The cottony cushion scale (*Icerya purchasi*) is found in Santa Barbara County in several orchards, and is also reported from Los Angeles and Santa Clara Counties.

The white scale (*Diaspis roseae*) is found on the blackberry and raspberry vines.

The San José scale, black scale, and the *Icerya purchasi* are found on various varieties of ornamental trees, and, in some cases, on vegetables.

There are several species of scale insects on ornamental trees and shrubs in gardens and other places throughout the State that are certainly dangerous to the fruit interests.

RED SPIDER.—The orchards and gardens throughout the State have a liberal supply of this pest (*Tetranychus telarius*).

CATERPILLARS.—In Marion County a species of tent caterpillar (*Clisiocampa constricta*) has done some damage.

In Santa Cruz the tent caterpillar (*Clisiocampa americana*) and the caterpillar of the Tussock moth (*Orgyia leucostigma*,) have done some damage; also in some localities in adjoining counties.

WOOLLY APHIS.—A serious amount of damage has been done to the apple trees throughout the fruit counties by this pest (*Myzocallis mali*).

BORERS.—The loss of trees in the orchards and gardens of this State from the different species of borers is very great.

SAND FLIES.—The damage done to foliage of pear trees by the larvæ of *Nematus similaris* and *Selandria cerasi* (pear slug) in 1881 was double that of any previous year.

Add to the above the fungi (*Fumago salicina*) found on fruit trees infested by black scale and the mildew, and it will be readily seen why a united warfare on insect pests, &c, should be organized. The question is often asked, how and when these insect pests came to the orchards of this State. It is not my intention to discuss the question at present, as I consider it of secondary importance. It is an undisputed fact that they are here, and the prominent inquiry should be, How can they be exterminated?

DAMAGE TO ORCHARD PROPERTY.

In the absence of statistical information, I have made diligent inquiry as to the damage done to orchard property in this State, and from such information as I received from reliable sources the actual depriciation in value is not less than $2,000,000.

DAMAGE TO FRUIT CROP OF 1881.

The orchard crop of 1881 produced less than 35 per cent. of choice marketable fruits; or, in other words, less than 35 per cent. of the entire crop produced in 1881 could be classed as choice marketable fruit.

From this statement—and I assure you it is not exaggerated—the prospects of the fruit-growing industry are not encouraging. However, the results are such as would be reached in any other industry conducted in the same manner. The system of fruit-growing as practiced in the past by a large number of orchardists may be termed the "go-as-you-please," and has produced a chaos from which order could only be restored by the aid of legislation. Such legislation has been obtained, and the object of this convention is to construct a solid foundation upon which can be organized an united warfare for the extermination of those evils which through negligence have been allowed to spread throughout the orchards of what may be termed the fruit-growing counties of this State.

The following is an extract from an address delivered by Dr. S. Chapin, of San José, on the same occasion:

By far the most injurious scale pest infesting our orchard trees and fruit is the one known recently as the San José small, round, black scale, and named by Professor Comstock *Aspidiotus perniciosus*. This scale produces terrible results in an orchard when once established. The trees become entirely covered with the scale, so that no portion of the bark can be seen. The fruit also, much of it, is in the same condition, rendering it unfit for use. The losses caused by the ravages of this insect cannot be computed easily. Whole orchards are literally destroyed by it. In many cases those who have recognized its presence and destructive power in time have made most strenuous efforts to stay its spread and save their trees, but it has been to a great degree discouraging, owing to the difficulties encountered in fighting an unknown foe. Within the past year, however, great progress has been made in destroying this insect, and it is hoped that it may be conquered within a reasonable time. It is altogether probable that within the coming year the fact will be made plain that a sure remedy has become available. As yet this terrible pest has not become common over many parts of the State, but it is increasing in localities outside of its starting place, until it now has a foothold which will surely bring sorrow to many orchardists, unless their eyes are opened to the consequences following its appearance and efforts at once directed to its extermination.

There is not time here to enter upon the history and description of this insect, but it is not now necessary, as a report upon it has already been made and is in print, and freely distributed to fruit-growers. I will merely state here that three distinct broods of this scale have been discovered this season; the first winged males of each brood being discovered on these dates: First brood, March 23; second brood, July 2; and the third brood, October 17.

The experiments made this season have been quite extensively carried on, and have, we feel confident, resulted in obtaining knowledge which is of practical benefit to all fruit-growers. A large number of these experiments have been printed in the report alluded to, and are available to you all, and will be more fully set forth in a report which will be submitted to the board of State horticultural commissioners.

Experiments have been very carefully made, using many substances, and their effects carefully noted. The most of these materials used have failed to result satisfactorily. This was expected, and they were tried with the object of demonstrating that fact, as negative results are often very valuable, as from their accurate record much labor and vexatious and even ruinous delay is saved. The results obtained have been as

> follows, stated in few words: The fact fortunately obtains that the treatment effectual in destroying the *Aspidiotus perniciosus* is likewise effectual for the destruction of all these other species of scale insects. The substances found to kill this scale have been concentrated by, first, kerosene; next, 110° or 150° test. These two for winter washes, and are only to be used when the tree is dormant. Then as an effectual application which can and should be made in summer, about the 1st to 15th of June, is the mixture of whale-oil soap and sulphur, known as "codlin moth wash." Referring to the experiments above made, examination was made a few days since of the tree No. 21, where the mixture was used in the summer. Its condition is most satisfactory; not a vestage of scale can be found upon the tree, and the tree is in a very healthy condition, the green layer of bark being rapidly restored.
>
> This wash is highly recommended, and should be used in the strength of 1 pound to 1 gallon water, and, if thoroughly applied at the time named, will afford very satisfactory results. My own judgment leads me to the use of concentrated lye as the best wash for winter use. This should be used as follows: 1 pound of the concentrated lye of the American Lye Company, broken up and dissolved in 1 gallon boiling water, for badly-infested trees; and 1 pound to 1¼ gallons water for less infested trees; 1 pound to 3 gallons is well adapted for washing, to cleanse trees of all accumulations of moss and other filth.
>
> I am prepared to aver that young orchards can be kept free from the *Aspidiotus perniciosus* by the right use of concentrated lye and the codlin moth wash. This, however, can only be accomplished by most patient watching and prompt measures when the pest is discovered.
>
> In the orchard mentioned in the report, a careful inspection is often made, and at this date not a specimen of this scale can be found, while I am sure that had the scale first appearing been neglected, the spread of the pest would by this time have been overwhelming. The lesson here presented is, make your examination most searching and do your work thorougly. It should be stated that the extensive washing or trees this winter by the use of lye and of kerosene will demonstrate fully the value or inefficiency of these materials.
>
> The best methods of applying insecticides is in the form of washes, and the most economical means thus far discovered is by the use of a force-pump with hose attached, and a suitable nozzle, producing a fine spray. Such a pump is the Gould force-pump. Another pump, and much cheaper and as serviceable, is the Merigot force-pump, manufactured at San José for this purpose. The best known spray-tip is the one made at San José by the same party, and called the San José scale bug spray-nozzle. One of the greatest difficulties in the use of strong materials is from the spray falling upon the person of the operator, and burning and injuring the skin. In order to overcome this obstacle I have devised a simple extension nozzle of slight cost, which is very light, and which may be made of any length desired, say from 4 to 15 feet, or even longer. By the use of this extension it is perfectly easy to reach and spray any orchard tree without danger and discomfort.
>
> In conclusion, the cost of apparatus and materials should be given. The Gould pump costs about $16 without accessories. The Merigot pump, $12; 5 feet suction, 25 feet best hose, plain nozzle with spray tip complete, excepting the extension nozzle, $9.50; extension nozzle, 4 feet, $2; 7½ feet, $3; extension nozzle 14 or 15 feet long, $4; branch for attaching two hose, $1.50; total coast of Merigot pump with accessories, $27.
>
> Concentrated lye, American Lye Company, 1-pound cans, by the case of 48 pounds, 7 cents per pound; kerosene, 110° test, California, by the barrel, barrel returned, per gallon, 15 cents; kerosene, 150° test, by case, per gallon, 30 cents; whale-oil soap and sulphur mixture, called the codlin moth wash, in quantities of 1,000 pounds, at 6¼ cents.

Of other insecticide solutions applicable as washes, a decoction of tobacco and the solution of sulpho-carbonate of potassium (the latter being now manufactured in California) have been very successfully employed.

The use of the vapor of carbon bisulphide, in a vapor-tight tent lowered over the tree by means of a derrick, and tightly fastened around the trunk, seems also to offer a feasible method, of easy applicability in the case of young orchards and in that of the compact-growing citrus trees. The mode of proceeding is described as follows by Mr. John H. Wheeler, secretary of the State boards of viticulture and horticulture:

> My tent was of canvas coated with perfectly tight and resistant impenetrable material. The body of the balloon was fashioned with hoops like a cylindrical Chinese lantern, which could be lowered from a derrick, and on completion of the treatment might, by tackles, be drawn up or closed up like a Chinese lantern. From the lower hoop hung a curtain, gathered at the bottom by means of strings, which could be

drawn up about the trunk of the tree and wound tight by the strings. The hoops which held the canvas off from the tree were so made that by means of a thumb screw they could be made large or small, the tent following, of course; by this means economy could be effected in treating trees of small horizontal diameter. Again, by the raising or lowering of the lower hoop the tent would fit trees tall or short. By means of the above adjustments, and the formation of the top of the tent, which was conical, there need be no waste space within and no consequent waste of material. This tent when put up would hold water to the very top.

To supply the sulphide of carbon, and to produce a saturated atmosphere as quickly as possible, I devised a series of three cotton disks suspended one above the other. On to the top one (the whole being suspended in the apex of the cone at the top of the balloon or tent) was poured the liquid bisulphide, which, evaporating in part, ran through on to the second, and then to the third, in such a manner that it all turned to vapor immediately, and, flowing down into the tent, would fill up the bottom first, and then rise to the top in a manner analogous to the filling of a vessel with water. Concerning the time required to put this balloon over a tree and inject the necessary bisulphide, it was found to take five minutes.

The insect to be experimented upon was principally the cottony cushion scale or *Icerya purchasi*, which gave the orange orchard, in parts, the appearance produced by a snow-storm passing over it, so thick were they on the foliage.

The work of applying is as follows:

Picture to yourself a man, woman, or child backing up a two-wheeled cart (weighing not more than 200 pounds, tent, cart, and all) on which is erected a derrick. The tree coming between the wheels, the tent is lowered by string or rope, the bottom drawn up about the trunk. One stroke of the piston of a small force-pump on the cart injects the necessary quantity of bisulphide (½ to 1 pound) after passing through a pipe, which follows over the arm of the derrick. By using a little brush broom and caustic solution, or even water alone, the trunk of the tree is freed from the insects, and a cordon of tar, lime, or similar material put about its foot to prevent others crawling up. This is the work of five minutes. For the hour or hour and a half during which the vapor is actively accomplishing its work of destruction, the laborer may be engaged with other balloons, or in pruning, hoeing weeds, &c. Disrobing, the tree is found in virgin condition. As to the cost of this process, it is found that for trees 10 to 14 feet high and 4 to 6 feet in diameter, the cost, including labor, cost of tent for 1,000 trees, bisulphide to be used, and incidentals, will not exceed 15 cents per tree. For large trees the cost multiplies rapidly, in proportion to the space occupied by the tree. In comparing the cost with that of treating by means of a wash, it is to be remembered that the complete extermination accomplished by a single treatment with carbon bisulphide is equivalent, if not more, to the three or four treatments necessary when a wash is used We find, therefore, that, even if the treatment with carbon bisulphide were necessary to repeat each year (of which I think there is little probability), it would then surpass in economy this treatment by means of washing.

QUARANTINE RULES

For the protection of the viticultural and horticultural industries of the State, declared under instructions of and by authority of the Board of State Viticultural Commissioners. First viticultural quarantine rules and recommendations.

BOARD OF STATE VITICULTURAL COMMISSIONERS,
OFFICE OF CHIEF EXECUTIVE VITICULTURAL OFFICER,
No. 111 Leidesdorff street, San Francisco.

To all whom it may concern:

Be it known that I, Charles A. Wetmore, chief executive viticultural and health officer of the board of State viticultural commissioners, being duly authorized and instructed by said board, do declare the following quarantine rules and regulations for the protection of the viticultural industries of this State; and due notice is hereby given as provided by law, to-wit, thirty days of publication in two daily newspapers of general circulation, not of the same city or county, in this State, and by posting notices in all counties affected by these rules. All parties concerned therein are required to conform thereto, subject to penalties provided for by law for any infraction or evasion of said rules and regulations:

QUARANTINE RULES AND REGULATIONS.

RULE 1. All cuttingsof grape-vines made in this State for sale or distribution outside of the vineyard or vineyards where the same were grown, and intended for new plantations, shall be made solely of the wood of the preceding year's growth; all older wood to be carefully and thoroughly removed before leaving the vineyard where made, and to be immediately destroyed by fire, if removed from such cuttings, wherever seized by any duly-authorized inspector for any evasion or infraction of this rule. The reason for this rule is that the winter egg of the *Phylloxera vastatrix* is, according to the best authorities, found only on the old wood.

RULE 2. All cuttings of grape-vines and rooted grape-vines imported from any region or country outside this State, intended for sale, gift, or distribution for plantation in this State, shall be disinfected at the place of first consignment within this State, before being further distributed or planted, the method of disinfection to be at the option of the owner or agent in charge of the said cuttings or vines, according to any one of the following methods, viz:

First. Dissolve sulpho-carbonate of potash in cold water; proportions, ten pounds of sulpho-carbonate to one hundred gallons of water; immerse cuttings and rooted vines fifteen minutes.

Second. Dissolve Little's soluble phenyle by pouring upon it cold water in the proportion of fifty gallons of water to one gallon of the phenyle; immerse cuttings and rooted vines ten minutes.

Third. Take two parts heavy oil of coal tar, two parts water, and one part carbonate of potash or carbonate of soda; put in a covered vessel and heat gently to boiling point for one hour; replace water lost by evaporation; pour into suitable vessels and agitate violently; dilute with fifty parts of cold water; immerse cuttings and rooted vines ten minutes.

Fourth. Dissolve carbolic acid crystals in water, in proportion of one pound of acid to twenty gallons of water; immerse cuttings and rooted vines ten minutes.

Fifth. Dissolve sulphide of potash in the proportion of one pound to twenty gallons of water; immerse cuttings and rooted vines ten minutes.

Sixth. Dilute one part of "liver of lime" in twenty parts of water; immerse cuttings and rooted vines ten minutes. [N. B.—To make "liver of lime," take one pound of quicklime, one pound of sulphur, one gallon of water; mix; boil over quick fire to one-half of volume; agitate before using; dilute with twenty parts of water to one part of "liver of lime."]

Any other efficacious method may be used, provided due notice is given to this office and the same be approved.

INSPECTORS.

For the convenience and protection of all interested parties throughout the State, there will be appointed local resident inspectors, as provided for by law, for each section or region where vine-growers desire the same, and upon the application of any three such neighboring growers, or parties intending during the coming season to plant vines, such application to be addressed to this office, and to be accompanied, whenever practicable, with nomination of suitable persons for the office of inspector. The other inspectors required by law will be appointed by this office.

RECOMMENDATIONS FOR THE FURTHER PROTECTION OF VINEYARDS.

All persons planting new vineyards within the State are advised and strongly urged to consider all roots and cuttings suspected, regardless of origin, and to thoroughly disinfect them, thereby accomplishing the destruction of all possible germs of insect pests upon them, as well also those of fungoid disease, which are becoming dangerous in all parts of the country.

CERTIFICATES.

For the further convenience of vine-growers, certificates shall be issued by any inspector residing near the vineyard of the applicant or the person in charge of cuttings or rooted vines, setting forth that the provisions of Rule 2 have been complied with, and shall be entitled to charge in each case not exceeding 50 cents for such certificates made out in duplicate, one certificate being sufficient to cover any quantity of cuttings or rooted vines in the possession of the applicant that may be satisfactorily shown to the said inspector to have been disinfected. Certificates of disinfection shall likewise be given any applicant who desires the same, and who shall satisfactorily show to the inspector that cuttings and rooted vines, other than such as are required to be disinfected by Rule 2, have been properly disinfected in accordance with the recommendations of this office.

INFECTED WRAPPINGS, ETC.

RULE 3. All packages and the packing materials coming into the State with imported cuttings and vines (referred to in Rule 2) shall be disinfected, at the time of disinfecting the contents thereof, by immersing in or washing with any of the solutions named in Rule 2, provided that the strength of the same, in case of mere washing, shall be increased by the reduction of the water in the same to one-fourth the relative proportions named. If not disinfected, such packages and packing materials shall be destroyed by fire.

PENALTIES.

All infractions or evasions of these rules will be punishable according to law.

CHAS. A. WETMORE,
Chief Executive Viticultural and Health Officer.

SAN FRANCISCO, *November* 16, 1881.

HORTICULTURAL QUARANTINE RULES.

To all whom it may concern:

Be it known that I, Matthew Cooke, chief executive horticultural and health officer of the board of State viticultural commissioners, being duly authorized and instructed by said board, do declare the following quarantine rules and regulations for the protection of the horticultural interests of the State; and due notice thereof is hereby given as provided by law, to wit, thirty days of publication in two daily newspapers of general circulation in the State, and by posting notices in all counties to be affected by these rules. All parties concerned therein are required to conform thereto, subject to penalties provided for by law, for any infraction or evasion of said rules and regulations.

QUARANTINE RULES AND REGULATIONS

For the protection of fruit and fruit trees from insect pests, namely, insects injurious to fruit and fruit trees, authorized and approved by the State board of viticultural commissioners of California.

In pursuance of an act entitled "An act to define and enlarge the duties and powers of the board of State viticultural commissioners, and to authorize the appointment of certain officers, and to protect the interests of horticulture and viticulture," approved March 4, 1881, the chief executive horticultural and health officer may appoint local resident inspectors in any and all of the fruit-growing regions of the State, whose duties shall be as provided in section 4 of an act entitled "An act to define and enlarge the duties and powers of the board of State viticultural commissioners, and to authorize the appointment of certain officers, and to protect the interests of horticulture and viticulture," provided that there shall be no compensation for such services or inspection excepting a fee not to exceed $1 for each certificate of disinfection, in case of compliance with quarantine regulations, and not to exceed $5 for each certificate of disinfection after seizure for non-compliance; provided, however, such inspection may be employed at the option of the owners of property requiring disinfection to disinfect the same. And also said local resident inspectors will be entitled to such other fees as are provided for in cases of conviction and seizures.

1. All tree or plant cuttings, grafts or scions, plants or trees of any kind, infested by any insect or insects, or the germs thereof, namely, their eggs, larvæ, or pupæ, that are known to be injurious to fruit or fruit trees, and liable to spread contagion, or any tree or plant cuttings, grafts, scions, plants, or trees of any kind, grown or planted in any county or district within the State of California, in which trees or plants, in orchards, nurseries, or places, are known to be infested by any insect or insects, or the germs thereof, namely, their eggs, larvæ, or pupæ, known to be injurious to fruit or fruit trees, and liable to spread contagion, are hereby required to be disenfected before removal for distribution or transportation from any orchard, nursery, or place where said tree or plant, cuttings, grafts or scions, plants or trees of any kind are grown, or offered for sale or gift, as hereinafter provided.

2. All tree or plant cuttings, grafts or scions, plants or trees of any kind imported or brought into this State from any foreign country, or from any of the United States or Territories, are hereby required to be disinfected immediately alter their arrival in this State, and before being for sale or removed for distribution or transportation, as hereinafter described; provided, that if on examination of any such importations by a local resident inspector, or the chief executive horticultural officer, a bill of health is certified to by such examining officer, then disinfection will be unnecessary.

3. Fruit of any kind infested by any species of scale insect or scale insects, or the germs thereof, namely, their eggs, larvæ, or pupæ,

known to be injurious to fruit and fruit trees, and liable to spread contagion, is hereby required to be disinfected as hereinafter provided, before removal off the premises where grown, for the purpose of sale, gift, distribution, or transportation.

4. Fruit of any kind infested by any insect or insects, or the germs thereof, namely, their eggs, larvæ, or pupæ, known to be injurious to fruit or fruit trees, and liable to spread contagion, imported or brought into this State from any foreign country, or from any of the United States or Territories, are hereby prohibited from being offered for sale. gift, distribution, or transportation.

5. Fruit of any kind infested by the insect known as codlin moth, or its larva or pupa, is hereby prohibited from being kept in bulk or in packages or boxes of any kind, in any orchard, storeroom, salesroom, or place, or being dried for food or any other purposes, or being removed for sale, gift, distribution, or transportation.

6. Fruit boxes, packages, or baskets used for shipping fruit to any destination are hereby required to be disinfected as hereinafter provided previous to their being returned to any orchard, storeroom, salesroom, or place to be used for storage, shipping, or any other purpose.

7. Transportable material of any kind infested by any insect or insects, or the germs thereof, namely, their eggs, larvæ, or pupæ, known to be injurious to fruit or fruit trees, and liable to spread contagion, is hereby prohibited from being offered for sale, gift, distribution, or transportation.

8. Tree or plant cuttings, grafts or scions plants or trees of any kind may be disinfected by dipping in a solution composed of not less than 1 pound of commercial concentrated lye to each and every 2 gallons of water used as such disinfectant, or in any other manner satisfactory to the chief executive horticultural and health officer.

9. Empty fruit boxes, packages, or baskets may be disinfected by dipping in boiling water, and allowed to remain in said boiling water not less than two minutes; said boiling water used as such disinfectant to contain in solution not less than 1 pound of concentrated potash, or three-fourths of 1 pound of concentrated lye, to each and every 20 gallons of water, or in any other manner satisfactory to the chief executive horticultural and health officer.

10. Fruit on deciduous and citrus trees infested by any species of scale insects or the germs thereof, namely, their eggs, larvæ, or pupæ, may be disinfected before removal from the tree, or from the premises where grown, by washing or thoroughly spraying said fruit with a solution composed of 1 pound of whale-oil soap and one-fourth of 1 pound of flour of sulphur to each and every 1¼ gallons of water used as such disinfectant, or in any other manner satisfactory to the chief executive horticultural and health officer.

11. Owners of fruit of any kind grown in any orchard, nursery, or place in which trees or plants are known to be infested with any insect or insects, or the germs thereof, namely, their eggs, larvæ, or pupæ, known to be injurious to fruit or fruit trees, and liable to spread contagion, and all persons in possession thereof or offering for sale, gift, distribution, or transportation, are hereby required to procure a certificate of disinfection before removal for sale, gift, distribution, or transportation.

12. Any tree or plant, cuttings, grafts, scions, plants, or trees of any kind, empty fruit boxes, fruit packages, or fruit baskets, or transferable material of any kind, offered for sale, gift, distribution, or transportation, in violation of the quarantine rules and regulations for the protection of fruit and fruit trees, approved by the board of State viticult-

ral commissioners, may be seized by the chief executive horticultural nd health officer, or by any of the local resident inspectors appointed y him; said seizure to be the taking possession thereof, and holding or disinfection, or for an order of condemnation by a court of competent urisdiction.

13. Any person violating the above quarantine rules and regulations hall be deemed guilty of a misdemeanor, and upon conviction thereof hall be punishable by fine of not less than twenty-five nor more than ne hundred dollars.

MATTHEW COOKE,
Chief Executive Horticultural and Health Officer.

SACRAMENTO, *November* 12, 1881.

ARIZONA AND NEW MEXICO.

By R. W. Furnas.

The topography and general characteristics of New Mexico and Arizona are much the same, and in this report, where not otherwise specifically mentioned, will be treated substantially under the same head.

The obstacles encountered in matter of transportation off the line of railroads were such as to prevent the commission from seeing and examining all localities desired.

A general summing up with reference to viniculture and horticulture of the two Territories warrants the belief that in the main what is said of California may be said of the most favored localities, in both Arizona and New Mexico, where irrigation is feasible.

The general character of the valleys is the same, and where experiments have been made results correspond. Arizona and New Mexico are, comparatively speaking, new and in the "heyday" of their precious-metal experience, and attention is almost exclusively given in that direction. Still, there are those who find the "almighty dollar" to satisfaction in tilling the soil. In Arizona there are numerous fertile valleys. Gila, Salt River, Little Colorado, Verde, San Simon, Sulphur Spring, San Pedro, Tonoita, Babacomoroi, Santa Cruz, Cienego, Arivaca, and Arivaipai are of note, with the smaller ones, Kirkland, Skull, Date Creek, Williamson, Big and Little Chino, Aqua Fria, Hassayampa, Big Sandy, in all of which more or less has been done in the way of successful experiments, agriculturally, viniculturally, and horticulturally. More, perhaps, has been accomplished in matters to which this report is more especially devoted in Salt River Valley, Maricopa County, than at any other point in Arizona. It is known in Arizona as the "garden spot of the Territory." Here the semi-tropical fruits, oranges, lemons, limes, figs, and European varieties of wine and raisin grapes are successfully grown. Wine-making has been engaged in to quite an extent, producing wines which compare favorably with those of California. It is found, too, that canning apricots and peaches is quite a successful industry in the surrounding country.

In the counties of Yuma and Mozave, embracing the great Colorado Valley, semi-tropical fruits have been grown satisfactorily. In Graham County, embracing the upper valley of the Gila, fruits of all kinds do well. The Valley of Santa Cruz, especially near Tucson, has been cultivated successfully for hundreds of years. The soil is rich and well adapted for fruit-growing. In the Sonoita Valley, southeast from Tucson some 50 miles, experience has shown that fruits for canning purposes, and grapes for wine and raisins, can be successfully grown.

In Pinal County, the valley of the Gila and San Pedro, peaches, pears, grapes, apricots, figs, quinces, and pomegranates have been tested, and the results are satisfactory. Those who have experimented freely express the belief that the region is peculiarly adapted to fruit culture, and predict it will ere long become one immense orchard and vineyard.

At and in the vicinity of all the old Franciscan missions are to be found evidences of early fruit-growing and wine-making. The old San Xavier del Bac mission, near Tucson, established as early as 1694, furnishes such evidences. Also the ruins of Saint Joseph, below Tubac. Others might be named, but these will suffice for present purposes.

DATA REGARDING AGRICULTURE IN NEW MEXICO.

As representative localties, Albuquerque Bernalillo, Socorro, Las Cruces, Mesillla, Upper Menbris, Hudson's Hot Springs, Belen, Las Lunas, Las Vegas, San Juan, and Santa Fé were visited and data obtained.

We find sufficient has already been done in New Mexico to demonstrate that all fruits flourishing in the Middle States are grown successfully in nearly all parts of the Territory; that is, in the valleys and foot-hills.

In Southern New Mexico semi-tropical fruits, oranges, lemons, pomegranates, and European varieties of grapes are grown to satisfaction.

The commission was pleased to note and report a greater area of available arable land in New Mexico than is generally supposed. The valleys are numerous, through which course rivers and streams of greater or less proportions. Some of the principal ones are, Rio Grande, San Juan, Chama, Canadian, Santa Cruz, Picures, Pojoaque, Tesque, Gallistio, San Cristoval, Colorado, Taos, Lucero, Pueblo, Pinos, Ojo Caliente, San José, Gila, Pecos, Benito, Hondo, Concho, Mora, Navajo, Cimarron. Vermijo, Rito Blanco, Florido, Animas, Plata, Chiquito, Zuni, Seven Rivers, Peñasco, Agna, Negra, and other smaller ones.

The valley of the Rio Grande, from the mouth of the Rio de Taos to the Mexican boundary, is between 300 and 400 miles long, with an average width of not less than 100, in which it is estimated there are 2,600 square miles of tillable land, with abundance of water for irrigating purposes.

All who have had experience agree that *wine* is one of the four great agricultural products of New Mexico—cattle, sheep, wool, and wine.

The whole valley of the Rio Grande, from a northern point, say near the latitude of Santa Fé, south, is found to be a fine wine-growing district. The native wine here made is popular, and is being exported to quite an extent.

The principal grape grown, and which has been cultivated for hundreds of years, is that known on the Pacific coast as the "Old Mission." Of late years more skilled attention has been given to the grape and wine industry, followed by increased and more satisfactory success. New vineyards are being planted, and the wine product is becoming more an article of commerce and profit.

At Bernalillo it is found that nearly all who cultivate the soil engage more or less in grape-culture and wine-making. The variety, in native parlance, is, "The old black sort our fathers always had—Mission."

A few persons we found cultivating the Muscat of Alexandria, and Muscatella Gordo Blanco—raisin varieties. But little attention, however, is given to raisin-making. Some were dried simply without sweating or packing, and were really fair as raisins.

The quality of such grapes as are raised in New Mexico we think not inferior to those grown in California. Digressively, we are reminded of irrigation. Here in New Mexico, as a rule, less water is used in irrigating than generally heretofore in California. The natives claim this as a reason for superior products. The commission noted in California that in very many instances there was over irrigation (too much water), followed by an inferior product. In fact, most successful irrigators everywhere now are those who use the minimum quantity of water. It is found that until of late years, comparatively, fully three-fourths more water has been used than was conducive to best results.

From Bernalillo there was shipped, 1881, over 25,000 pounds of table-grapes. Peaches, pears, apricots, and apples succeed well in this vicinity. Peaches cannot be depended on north of this point, except perhaps in peculiarly sheltered and otherwise favorable localities.

South, to El Paso, may be found in perfection white and red wines. An important feature is that we heard of no ills to which the vine has, thus far, been subject in New Mexico.

In the Pecos Valley, near Anton Chico, grapes and peaches are grown in profusion and perfection; and so for near 100 miles below Fort Sumner.

At Santa Fé abundance of staple fruits were found; nothing, however, of a semi-tropical character.

In the valley of the Navajo are found fine peach orchards; also 50 miles west of the Sierra Madre summit. At the mouth of the Zuni, in the valley of the Little Colorado, is said to be a most excellent fruit region.

After personal visitation and observation of portions of New Mexico named, and obtaining reliable information from nearly all parts of the Territory, we learn that, especially in, say, the southern half, the soil, climate, and general conditions are much the same as found in California. In many places the same peculiar soil formation exists as that by which the Sonoma and Napa regions in California are characterized and have become noted as wine-producing localities—decomposed volcanic rock, which it is claimed imparts to grapes desired and essential vinous property.

Therefore, to conclude, we feel warranted in asserting a belief that those particular sections of New Mexico indicated are well adapted to growing such grapes as are most in use and required for successful wine-making; and also such fruits as are most desirable for commercial purposes—canning and shipping.

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[Report #21]

DEPARTMENT OF AGRICULTURE.

FLORIDA:

ITS

CLIMATE, SOIL, PRODUCTIONS,

AND

AGRICULTURAL CAPABILITIES.

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FLORIDA: ITS CLIMATE, SOIL, PRODUCTIONS, AND AGRICULTURAL CAPABILITIES.

Florida, from its first discovery in 1512, has been in an unsettled condition, conquered and reconquered, ceded and receded, harassed by Indian wars, and when just entering on a period of stability and prosperity plunged into a civil contest, which decimated and impoverished her people. Ceded to the United States in 1821, and admitted as a State in 1845, her resources have remained latent and undeveloped, and her 60,000 square miles of territory comparatively wild and uninhabited until about the close of the late civil war. Since that period the intelligence of the world has been directed to this favored land, and thousands have annually sought health and pleasure and new homes within her borders. Other thousands will come, when informed of the advantages and attractions of this productive semi-tropical State, only awaiting capital and industry to render it one of the wealthiest and most prosperous of the Federal Union.

The peninsular portion of the State, known as East and South Florida, is some 300 miles in length from north to south, and averages about 100 in width, gradually narrowing towards its southern terminus. The Gulf Stream on its eastern coast causes the trade winds of the Atlantic to sweep over the land from east to west by day, while the returning cool breezes from the Gulf refresh the land by night. These daily breezes constantly purify and vivify the atmosphere, and prevent oppressive heat or sultriness.

Generally the lands bordering on the ocean and Gulf are level and at no great elevation above tide-water; midway there is a table-land elevation, reaching nearly to the everglades. The extreme southern portion is low, though, from recent surveys, it is found that it can be effectually drained and made available for cultivation.

No State in the Union has such an extent of coast, being nearly 1,200 miles in length, extending from Fernandina on the north to Pensacola on the west, indented every few miles by large bays, running inland in many places from ten to thirty miles, with large rivers like the Saint John's, Oclawaha, Kissimmee, Indian, Halifax, Saint Mary's, Suwannee, and Apalachicola, navigable from north to south, and easterly and westerly between the Gulf and Atlantic Ocean. There are other connecting navigable streams in all parts of the State, and lakes, large and small, scattered and grouped together, all of which furnish local transportation facilities, and abound in excellent varieties of fish; many connect with navigable streams, and all can be easily connected by short canals or railroads with each other and the great arteries of water leading to the sea and Gulf. The interior lakes of Florida, large and small, is one of its remarkable features. The largest of these is Lake Okeechobee, situated in the middle of the table-lands of the peninsula, and contains an area of 1,000 square miles, without visible outlet to the sea.

The soil in the greater portion of the State is sandy, except in the hill lands and hammocks, where large portions of clay and alluvium are found. The sand is not the sharp, siliceous sand of the ocean, or resembling the sandy lands of other States; this soil has more or less of loam and a large percentage of lime and organic remains, giving it much fertility. The country is well watered, not only by its larger and smaller rivers and lakes, but by innumerable creeks and springs. Springs of great volume are found in every portion of the State, some of such magnitude that they form navigable rivers from their source; of such are the Blue Springs, in Jackson County, in the west; Wakulla Springs, in Wakulla County; Blue Springs, in Hernando County, in the middle; Silver Springs, in Marion County, in the east; the very large Blue Spring on the Saint John's, in Volusia County; the Green Cove Springs, in Clay County, on the shore of the Saint John's; also Clay Spring, in Orange County. Some of these are medicinal—white sulphur, iron, &c. Good water, so universally desired, is found easily at a depth of from eight to fifty feet, according to locality, generally from twelve to twenty feet, but, through the country, the many lakes, and springs, and branches afford ample supply for house and farm purposes. If cistern water is preferred, the average rainfall, being from forty-eight to fifty-four inches annually, insures a supply. The distribution of rivers, creeks, lakes, and springs is not only large, but remarkably uniform throughout the State. Pine lands (pitch and yellow pine) form the basis of Florida. These lands are usually divided into three classes, denoting first, second, and third rate pine lands.

That which is denominated "first-rate pine land" in Florida has nothing similar to it in any of the other States. Its surface is covered for several inches deep with a dark vegetable mold, beneath which, to the depth of several feet, is a chocolate-colored sandy loam, mixed for the most part with limestone pebbles, and resting upon a substratum of marl, clay, or limestone rock. The fertility and durability of this description of land may be estimated from the well-known fact that it has in several districts yielded during fourteen years of successive cultivation, without the aid of manure, four hundred pounds of Sea Island cotton to the acre. These lands are still as productive as ever; so that the limit of their durability is yet unknown. The "second-rate pine" lands, which form the largest proportion of Florida, are all productive. These lands afford fine natural pasturage; they are heavily timbered with the best species of pitch and yellow pine. They are for the most part high, rolling, healthy, and well watered. They are generally based upon marl, clay, or limestone. They will produce for several years without the aid of manure, and, when fertilized, they will yield two thousand pounds of the best quality of sugar to the acre, or about three hundred pounds of Sea Island cotton. They will also produce rice, tobacco, oats, corn, rye, and all the vegetable varieties, as well as the various tropical fruits, which render them more valuable than the best bottom lands in the more northern States.

The lands of the "third rate," or most inferior class, are by no means worthless under the climate of Florida. This class of lands may be divided into two orders; the one comprising high, rolling, sandy districts, which are sparsely covered with a stunted growth of "black-jack" and pine; the other embracing low, flat, swampy regions, which are frequently studded with "bay galls," and are occasionally inundated, but which are covered with luxuriant vegetation and generally with valuable timber. The former of these, it is now ascertained, owing to its calcareous soil, is well adapted to the growth of the Sisal hemp, which is a valuable tropical production. This plant (the *Agava Siciliana*), and the *Agave Mexicana* hemp, also known as the maguay, the pulque plant, the century plant, &c., have both been introduced into Florida, and they both grow in great perfection on the poorest lands of the country. As these plants derive their chief support from the atmosphere, they will, like the common air-plant, preserve their vitality for many months when left out of the ground.

These lands, besides being valuable for their timber and the naval stores which they will produce, afford an excellent range for cattle, and are susceptible of cultivation in the various productions, when properly ditched and drained.

There is one general feature in the topography of Florida which no other country in the United States possesses, and which affords a great security to the health of its inhabitants. It is this: that the pine lands which form the basis of the country, and which are almost universally healthy, are nearly everywhere studded, at intervals of a few miles, with hammock lands of the richest quality. These hammocks are not, as is generally supposed, low, wet lands; they never require ditching or draining; they vary in extent from 20 acres to 40,000 acres, and will probably average about 500 acres each. Hence, the inhabitants have it everywhere in their power to select residences in the pine lands, at such convenient distances from the hammocks as will enable them to cultivate the latter without endangering their health, if it should so happen that any of the hammocks proved to be less healthy than the pine woods.

Experience in Florida has satisfactorily shown that residences only half a mile distant from cultivated hammocks are entirely exempt from malarial diseases, and that the negroes who cultivate those hammocks and retire at night to pine-land residences, maintain perfect health. Indeed, it is found that residences in the hammocks themselves are generally perfectly healthy after they have been a few years cleared. Newly-cleared lands are sometimes attended with the development of more or less malaria. In Florida the diseases which result from these clearings are generally of the mildest type (simple intermittent fever), while in nearly all the Southern States they are most frequently of a severe grade of bilious fever.

The topographical feature here noted, namely, a general interspersion of rich hammocks, surrounded by high, dry, rolling, healthy pine woods, is an advantage which no other State in the Union enjoys; and Florida forms in this respect a striking contrast with Louisiana, Mississippi, and Texas, whose sugar and cotton lands are generally surrounded by vast alluvial regions, subject to frequent inundations, so that it is impossible to obtain within many miles of them a healthy residence.

The lands which in Florida are, *par excellence*, denominated "rich lands," are, first, the "swamps lands"; second, the "low hammock lands"; third, the "high hammocks"; and fourth, the "first-rate pine, oak, and hickory lands."

The swamp lands are unquestionably the most durably rich lands in the country. They are the most recently formed lands, and are still annually receiving additions to their surface. They are intrinsically the most valuable lands in Florida, being as fertile as the hammocks and more durable. They are evidently alluvial and of recent formation, and occupy natural depressions of basins which have been gradually filled up by deposits of vegetable débris, &c., washed in from the adjacent and higher lands. Ditching is indispensable to all of them in their preparation for successful cultivation. Properly prepared, however, their inexhaustible fertility sustains a succession of the most exhausting crops with astonishing vigor. The greatest yield of sugar ever realized in Florida was four hogsheads per acre, produced on a plantation on Indian River, on which is now located the large orange grove which has given character to the oranges of Florida—the Dummitt Grove, recently purchased by an Italian nobleman, the Duke de Castelluccia. Sugar cane is here instanced as a measure of the fertility of the soil, because it is one of the most exhausting crops known, and is generally grown without rest or rotation. It is not, however, a fair criterion by which to judge of the relative fertility of lands situated in different climates, for we find on the richest lands in Louisiana the crop of sugar per acre is not more than one hogshead, or about half that of East Florida.

This great disparity in the product of those countries is accounted for, not by any inferiority in the lands of Louisiana or Texas, but from the fact that the early incursions of frost in both these States render it necessary to cut the cane in October, which is long before it has reached maturity, while in East Florida it is permitted to stand without fear of frost till December, or till such time as it is fully matured. It is well known that it "tassels" in East Florida, and it never does so in either Louisiana or Texas. When cane "tassels" it is evidence of its having reached full maturity.

In consequence of the heavy outlay of capital required in the preparation of this description of land for cultivation, and from the facility of obtaining hammock land, which requires no ditching or draining, swamp lands have been but little sought after by persons engaged in planting in Florida, and there is now at least a million of acres of the best description of this land vacant in the country, which can be secured at less than two dollars per acre.

Low hammocks, from the fact of their partaking of the nature of hammocks and swamps, and sometimes termed "swammock," are not inferior to swamp lands in fertility, but perhaps are not quite as durable. They are nearly always level, and have a soil of greater tenacity than that of the high hammocks. Some ditching is necessary in many of them. The soil is always deep. They are also extremely well adapted to the growth of the cane, as has been well attested by the many plantations which were formerly in operation here on this description of land. There is not so large a proportion of low hammock as there is of swamp lands.

High hammocks are the lands in the greatest repute in Florida. These differ from low hammocks, in occupying higher ground, and in generally presenting an undulating surface. They are formed of a fine vegetable mold, mixed with a sandy loam, in many places two feet deep, and resting in most cases on a substratum of clay, marl, or limestone. It will be readily understood by any one at all acquainted with agriculture, that such a soil, in such a climate as Florida, must be extremely productive. This soil scarcely ever suffers from too much wet, nor does drought affect it in the same degree as other lands. High hammock lands produce, with but little labor or cultivation, all the crops of the country in abundance. Such lands have no tendency to break up in heavy masses, nor are they infested with pernicious weeds or grasses. Their extraordinary fertility and productiveness may be estimated by the fact that in several well-known instances in Marion County three hogsheads of sugar have been made per acre on this description of land, after it had been in cultivation six years in successive crops of corn, without the aid of manure.

To sum up its advantages, it requires no other preparation than clearing and plowing to fit it at once for the greatest possible production of any kind of crop adapted to the climate. In unfavorable seasons it is much more certain to produce a good crop than other kinds of land, from the fact that it is less affected by exclusively dry or wet weather. It can be cultivated with much less labor than any other lands, being remarkably mellow, and its vicinity is generally high and healthy. These reasons are sufficient to entitle it to the estimation in which it is held over all other lands. There are, besides the lands already noticed, extensive tracks of savanna lands, which approximate in character, texture of the soil, and period and mode of formation, to the swamp lands, differing only in being destitute of timber. These savannas yield an immense crop of grass, which if cut and properly cured would afford a quality of hay equal to the marsh hay of the Northwest.

In Middle Florida, the counties of Leon, Gadsden, Jefferson, and Madison have large quantites of high, rolling hammock lands, also the county of Jackson in West Florida. They are more undulating than those in East Florida, and are underlaid with a stiff red clay. They are by far the best lands in the State for short-staple cotton, to which they have been almost exclusively appropriated, and to wheat, rye, oats, corn, tobacco, &c. In Volusia County there is a range of low hammock a little back from the coast, from a half to two miles wide, and extending from the head of the Halifax to the head of the Indian River, some 50 miles, as well adapted to sugar culture as any land in the State. The Gulf Hammock, in Levy County, comprises perhaps the largest body of rich land in Florida. It was bought up years ago at from $5 to $10 per acre, by private parties, by whom it is mostly held at the present time. The Atlantic, Gulf and West India Transit Railroad runs through it, and it will no doubt become at an early day one of the garden spots of the State. The clearing of the hammocks, however, is expensive, and, as in every new country, we may expect to see the lands more lightly timbered first brought into cultivation.

CLIMATE.

The climate of Florida, from parallel 31, its northern boundary, to 29, corresponds with that of Portugal, south of Oporto; the southern section of Spain; Oran, Algiers, and Tunis, on the northern coast of Africa; the southernmost part of Italy; the islands of Sicily, Greece, Morea; the isles of the Archipelago, and those of Candia, Rhodes, Cyprus, &c.; Asia Minor, Syria, Mesopotamia, and Armenia. From latitude 29 to 25, bordering almost on the tropics, and including the remainder of East Florida, containing about 33,000,000 acres of land, there is no parallel climate in Europe or Asia Minor.

As climate, in its effects upon the health and vigor of mankind, is of fundamental importance, and enters more largely into the considerations connected with the industrial occupation and development of the country, and as Florida is receiving more special attention from the migratory world than common, I shall be pardoned if I occupy some space in giving the results of scientific investigations in regard to the constituent elements of the climate of this semi-tropical region.

Dr. C. J. Kenworthy, of Jacksonville, a gentleman of extensive experience, as well as practical research, in an address before the Medical Association of Florida, in 1880, presents a more thorough analysis of the constituent elements of the atmosphere and climate of Florida than has yet been given to the public, and I avail myself of his work, and embody the results in liberal extracts.* He says:

The climate of Florida is not excelled by that of any of the United States, and it may be doubted whether it can be equalled elsewhere in the world. Located on the very borders of the torrid zone. and, therefore, so far as latitude alone is concerned, entitled to rank among the hottest portions of the western continent, still her situation between the Gulf of Mexico and the Atlantic is such that, owing to her peculiar form, she is swept alternately by the winds of eastern and western seas, and relieved from those burning heats with which she would otherwise be scorched; and thus it happens that by the joint influences of latitude and peculiar location, she is relieved on the one hand from the rigors of the winter climate of the Northern and Middle States, and on the other from the extreme heat by which not only the other Southern States, but in the summer time the Northern States, are characterized.

While in winter the Northern and Middle States are covered with snow, and frost penetrates the earth to the depth of several feet, and the leafless trees wave their bare and skeleton fingers in the wintry wind, in Florida most of the trees and shrubs are in full foliage, and the winter gardens are filled with vegetables in their most thrifty growth.

In the Northern States the frosts of November and December most effectually put a stop to all agricultural operations, and the farmer is compelled to feed his stock for from four to six months, and is himself confined to the getting of fuel and lumber, thus in one portion of the year consuming a large share of the result of his labor in the other

But in Florida this very winter season is better adapted to building, clearing land, and the performance of all necessary extra work on the farm than even the summer.

In the North all regular farming work is of necessity crowded into the space of less than half the year, while in Florida there is scarcely a single day in the whole year that may not be devoted to purely agricultural work.

In some of the Northern States the mean average range of the thermometer is from 30° below zero to 90° and 100° above. In Florida, for many years, the range of the thermometer has been less than half as great.

The word "climate" in its common signification indicates a region bounded by certain arbitrary lines, but in medicine it possesses a wider meaning. The effect of climate upon the human system is the sum of the influences which are connected with many factors. The climate of any locality, professionally speaking, depends upon its temperature, atmospheric vicissitudes, prevailing winds, humidity, its elevation above the sea level, its proximity to the ocean or oceanic currents, its contiguity to mountains, lakes, rivers, arid areas, soil, drainage, vegetable productions, malaria, general sanitation and other factors, which we shall briefly consider.

Considering climatic factors, as a result of experience, observation, investigation, and study, we are convinced that Florida presents more attractions and advantages as a winter resort for invalids than any State in the Union. The temperature is favorable, the mean relative humidity is peculiarly adapted to the treatment of all forms of pulmonary disease, the air is salubrious, and in a large portion of the State dry and bracing; atmospheric changes are infrequent, and not so great as in other sections east of the Rocky Mountains. Rains are infrequent, and sunshine and fine weather the rule. The State possesses insular, interior, dry and moist localities, semi-tropical and cooler sections; and if the nature of any given case should necessitate a change of base, a suitable climate can be reached in a few hours and at a trifling expense.

Dr. Charles A. Lee, the learned editor of Copeland's Medical Dictionary, remarks:

Proceeding south from Canada to Florida, the seasons become more uniform in proportion as their annual temperature increases, and they glide imperceptibly into each

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*Climatology of Florida, by C. J. Kenworthy, M. D., of Jacksonville. Reprint from Transactions Florida Medical Association, session 1880.

> other, exhibiting no great extremes. Compared with the other regions of the United States, the peninsula of Florida has a climate wholly peculiar. The climate is so *exceedingly mild and uniform* that, besides the vegetable productions of the Northern States generally, many of a tropical character are produced. We have already spoken of the mildness of the climate of this region; it appears to possess an insular temperature not less equable and salubrious in winter than that afforded by the South of Europe, and is, therefore, well adapted to those forms of pulmonary disease—as bronchitis and incipient phthisis—as are benefited by a mild climate. ***Mildness and uniformity*** are the two distinguishing characteristics of the Florida peninsula. If we compare the climate of East Florida with the most favored situations on the continent of Europe, and the islands held in the highest estimation for mildness and equability of temperature, in regard to the mean temperature of winter and summer, that of the warmest and coldest months, and that of successive seasons, we shall find the results generally in favor of the former.

After citing the mean difference of successive months and annual range of a number of climatic resorts in comparison with stations in Florida, he remarks:

> Thus it is easily demonstrated that invalids requiring a mild winter residence have gone to foreign lands in search of what might be found at home—an evergreen land, in which wild flowers never cease to unfold their petals.

In discussing the most suitable climates for invalids, Dr. Wilson, late medical inspector of camps and hospitals, United States Army, remarks:

> Neither upon the southern coast of France, nor anywhere under the bright Italian skies, can a winter climate be found so equable and so genial to the delicate nerves of most invalids as can be enjoyed in our sanitary stations in Florida.

Temperature is an important factor in climate, and Dr. A. S. Baldwin, of Jacksonville, in an address before the medical association, gives tabular statements of mean temperature at eighteen different stations in Florida during a term of years, including his own observations, which extend through a period of thirty-six years.

From this table it appears that the mean temperature for the entire State is: For spring, 71° 62′; summer, 80° 51′; autumn, 71° 66′; winter, 70° 05′.

For stations on and south of latitude 28° north: Spring, 74° 94′; summer, 81° 93′; autumn, 76° 27′; winter, 63° 69′; and for the year, 74° 87′.

For the stations north of latitude 28° north: Spring, 70° 66′; summer, 80° 10′; autumn, 70° 23′; winter, 58° 29′; and for the year, 69° 82′.

During the spring the temperature south of latitude 28° north is 4°. 28′; for summer, 1° 83′; for autumn, 6° 34′; and for winter, 5° 40′ higher than it is north of 28°; showing that the difference between the summer and winter temperature is less south than north of parallel 28. After explaining the astronomical law which governs, the doctor remarks:

> Although there is more absolute heat at Jacksonville, Fla., latitude 30°, during the entire year than there is at Milwaukee, Wis., latitude 43° 03′, yet there is more heat received from the sun at the latter place during the three summer months than at the former during the same period, and Wisconsin is liable to experience a higher temperature during the summer months than is Florida during the same time.

The comparative humidity of Florida, as connected with health, is shown in the appended tables, presented in the valuable address of Dr. C. J. Kenworthy, of Jacksonville, before cited:

The mean relative humidity of the localities referred to, for the cold months, is as follows:

Localities.	November.	December.	January.	February.	March.	Mean for 5 months.	Mean for 5 months.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Cannes and Mentone	71.8	74.2	72.0	70.7	73.3	72.4	
Augusta, Ga	71.8	72.6	73.0	64.7	62.8	68.9	
Breckinridge, Minn	76.9	83.2	76.8	81.8	79.5	79.6	74.3
Duluth, Minn	74.0	72.1	72.7	73.3	71.0	72.6	
Saint Paul, Minn	70.3	73.5	75.2	70.7	67.1	71.3	
Jacksonville, Fla	71.9	69.3	70.2	68.5	63.9	68.8	72.7
Key West, Fla	77.1	78.7	78.9	77.2	72.2	76.8	
Punta Rassa, Fla	72.7	73.2	74.2	73.7	69.9	72.7	

From the above data it appears that the mean relative humidity of Cannes and Mentone, during the cold months, exceeds that of Jacksonville by nearly 4 per cent. Three stations in Minnesota have a mean of 74.3, and three in Florida a mean of 72.7, showing a per cent. of 1.6 in favor of Florida, and 5.5 per cent. in favor of Jacksonville over Minnesota.

If we take the entire year, for a period of five years, we will find but little difference in the mean relative humidity of Minnesota and Florida, as the following data, kindly furnished us by the Chief Signal Officer of the United States Army, will demonstrate:

Years.	Minnesota.			Florida.		
	Breckinridge.	Duluth.	Saint Paul.	Jacksonville.	Punta Rassa.	Key West.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1875	75.7	67.2	69.0	70.3	76.0	71.5
1876	67.7	68.2	69.1	67.2	73.9	76.1
1877	72.2	71.9	67.6	69.3	70.5	74.1
1878	76.2	71.5	67.7	68.7	72.4	74.5
1879	74.1	72.8	65.8	60.7	72.3	74.2
Mean for five years	73.2	70.3	67.7	69.0	73.0	74.2
Mean for five years for States	....	70.4	....	....	72.1	....

Thus it will be perceived that Jacksonville possesses a lower mean relative humidity than most of the celebrated winter resorts. There is one important point to which I wish to direct your attention, and that is the remarkably low percentage of humidity during the much dreaded month of March—the mean for five years being but 63.9, as against 73.3 at Mentone, 76.8 at Atlantic City, 79.5 at Breckinridge, Minn., 68.4 at Nassau, N. P., and 67.1 at Saint Paul. When referring to the effects of change of climate, Dr. Madden remarks: "The temperature of a locality, to which so much importance is properly assigned, is no criterion of its climate as a health resort, the fact being that invalids are painfully sensible of variations in the *hygrometric state of the atmosphere*, which are in no way indicated by the thermometer, so much relied on."

The thermometric range in this city is not too high nor too low. As evidence of this, we find the mean temperature for the five cold months, for five years, to be for November, 62°.1; December, 55°.8; January, 56°.2; February, 56°.9; March, 62°.7; mean for five months, 58°.7.

Dr. Lente, p. 17, when discussing temperature as a constituent of climate, and referring to certain winter resorts north of Florida, remarks: "A mean winter temperature of about 48° is too low to *entice* many of the feeble invalids out of doors, except in calm and sunshiny weather. But in some of them this degree of cold is enhanced, as far as the sensations are concerned, by the winds which frequently prevail. At such times, most invalids will, therefore, be found hovering over the comfortable wood fires, and will be pretty sure to keep all the apertures of their chambers closed at night, thus depriving themselves, during by far the greater part of the twenty-four hours, of the principal means of cure. In Florida the sun shines so brightly, the air is so balmy, the songs of the birds so enlivening, and the orange trees in their bloom, or laden with their golden fruit, lend such a charm to the outlook from the windows, that the most indolent or the most cold-blooded invalid feels little inclined to stay in doors."

Prof. J. Hughes Bennett, of the University of Edinburgh, remarks: "And when, in our own country, the question arises, Where shall we send the consumptive patient in order to avoid our changeable climate and cold winter winds in winter? we naturally say: To a land where, during that portion of the year, the weather is warm and equable. Much has been written on climate, but the one which appears to me best is that which will enable the phthisical patient to pass a few hours every day in the open air, without exposure to cold or the vicissitudes of temperature on the one hand, or excessive heat on the other."*

With the exception of the month of December, fogs are seldom seen, and when they do occur they are not dense, and disappear as soon as the sun appears above the horizon. Interested parties have intimated that the city of Jacksonville is a "rainy locality," and, in consequence, an "unsuitable place for invalids." To correct this error, we will furnish data applicable to a few winter resorts, from reliable sources:

RAINFALL IN INCHES AND HUNDREDTHS.

Localities.	Number of years.	November.	December.	January.	February.	March.	Five months.
Nice	28	5.11	4.12	3.06	1.68	2.89	16.86
Mentone	9	5.34	3.15	1.70	2.18	4.13	16.50
Nervi	7	6.00	4.88	4.78	2.33	4.49	23.48
Genoa	29	7.61	4.86	4.39	4.27	3.59	24.72
Atlantic City, N. J	5	4.61	3.60	2.76	2.10	3.86	16.93
Augusta, Ga	5	4.56	3.09	3.70	3.64	5.65	20.64
Jacksonville, Fla	5	3.02	3.38	2.34	5.14	2.84	16.62
Key West, Fla	5	2.43	1.33	2.18	2.22	0.94	9.10
Punta Rassa, Fla	5	2.38	0.99	1.69	2.67	1.04	8.77

We have referred to sunshine as an important aid in the treatment of disease and broken health, and as an evidence that Florida is favored with sunshine and fair weather, and not "cloudy, foggy, and rainy weather," as interested parties have asserted, I shall direct your attention to the following meteorological data, furnished by J. W. Smith, the observer in charge of this station:

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* Bennett's Practice of Medicine, pp. 326, 476.

METEOROLOGICAL DATA FROM SIGNAL OFFICE, U. S. A., JACKSONVILLE, FLA.

Date.	Rainy days.					Remarks.
	November.	December.	January.	February.	March.	
1874–1875	14	6	15	10	5	"Rainy days," all days on which rain fell.
1875–1876	10	4	4	8	7	
1876–1877	5	10	6	6	6	
1877–1878	9	9	5	10	8	
1878–1879	5	8	5	9	3	
Average	8.6	7.4	7	8.6	5.8	37.4 days in five months.
	Cloudy days.					
	November.	December.	January.	February.	March.	
1874–1875	4	6	12	3	8	
1875–1876	8	4	5	7	2	
1876–1877	6	3	2	10	7	
1877–1878	10	11	11	9	10	
1878–1879	9	11	5	11	4	
Average	7.4	7	7	8	6.2	35.6 cloudy days five months.

J. W. SMITH,
Observer in Charge.

When a day is marked "rainy," but a few drops may have fallen, and it is no evidence that the entire day was rainy. A measurable or a non-measurable quantity may fall in a few minutes, and the remainder of the day be bright and clear. In Florida the rains are frequently "torrential, in short, severe bursts," followed by bright and clear weather. For the purposes of comparison, we will refer to the number of rainy days during the cold months in Jacksonville, Mentone, and Saint Paul.

RAINY DAYS (INCLUDING SNOW).

Locality.	Years.	November.	December.	January.	February.	March.	Five months.
Jacksonville	5	8.6	7.4	7	8.6	5.8	37.4
Mentone	8	10.1	7.25	5.1	5.66	9.55	37.48
Saint Paul	1	4	13	8	6	11	42

Ozone is considered an important constituent of the atmosphere, for by its presence pure air may be inferred to exist. This allotropic condition of oxygen possesses great power of destruction of organic matter floating in the atmosphere. The Florida peninsula is surrounded by the sea, and the land is almost constantly fanned by sea-breezes, containing a large amount of ozone. According to the researches of Burdel, he found as "much ozone in the air of marshes as in other air." Clemens says: "There is a large proportion of oxygen near the surface of lakes, giving the reaction of ozone," more especially if there are certain aquatic plants present; and he also remarks that at some feet above the surface the reaction is lost. Grallois has lately stated that he "found more ozone over marshes than anywhere else." Dr. Schreiber, of Vienna, asserts "that the turpentine exhaled from pine forests possesses, to a greater degree than all other substances, the property of converting the oxygen of the air into ozone." In this connection, Dr. Denison remarks: "If this be true, it will explain why a residence among the balsamic odors of the pines has long been esteemed of benefit to the pulmonary invalid." Florida is densely covered with pine forests, and if we accept the statement of Dr. Schreiber, Dr. Jones is in error. Dr. Moffat found the quantity of ozone in the atmosphere greater when the mean daily temperature was above the mean. According to the researches of Dr. Denison in Colorado, the excess of ozone appeared during the spring months on the plains, and came proportionately later in the season the higher up the observations were made. Says Dr. Kenworthy:

> Malaria is a subject which enters into the discussion of all southern climes, and we unhesitatingly assert that Florida has been misrepresented in this respect. "It is the custom," remarks Dr. Lente, p. 21, "of many persons living at Florida resorts, off the Saint John's River, to represent, for obvious reasons, that fever prevails there the year round, and that it is dangerous to resort to it at any time. In this manner they have excited senseless alarm in the minds of those proposing to come to Florida, and have diverted them to other Southern resorts, thus in the end injuring themselves as well as others." Unprincipled hotel keepers and runners, and the agents of steamboat and railroad lines leading to other localities, aid more or less in this fraudulent attempt to gain patronage. The bugbear, malaria, is, in my humble opinion, a prolific source of disease among visitors to Florida. By misrepresentations (to use a mild term) tourists and invalids have been led to believe that the entire water supply is productive of disease, and as a consequence they refrain from drinking a sufficient quantity of water, or dilute it with poor whisky or brandy to counteract its bad effects Interested parties have expatiated so much with regard to the air being charged with malaria in winter, that invalids and patients become alarmed, and as a sequence they daily swallow quinine, and thereby produce nervous or functional derangements. They keep the pure air out of their rooms, breathe an air contaminated with their own breaths and exhalations, and at night assemble in halls and parlors and inhale vitiated air poisoned by their own breaths and the elements resulting from the combustion of coal-gas and kerosene. They inhale for hours at a time air charged with carbonic acid, and shun the pure night air as they would the emanations of the deadly Upas tree. Visitors act imprudently, and as a consequence suffer from nervous derangements, colds, and diarrhœas, which they attribute to malaria or the climate. The cause of slight indispositions affecting visitors is not malaria, but indulgence at table, change of drinking water, eating excessive quantities of fruit, or the inhalation of air poisoned by human breaths, or the resultants of the combustion of coal-gas and kerosene, and a deficiency of the pure air that a beneficent Creator has placed everywhere within their reach. If visitors would let quinine and arsenical pills alone, control their appetites, eat moderately, inhale plenty of the salubrious air of the State, and not swelter in heated halls, parlors, and unventilated bed-rooms, we should hear less of the bugbear, malaria.

At various times since 1844, I have navigated the larger streams of this State, visited the everglades and Lake Okeechobee, and almost every bay, inlet, and river, from Cape Sable to the Suwannee River, and for over two months at a time slept in an open boat, with nothing but a simple awning stretched over the boat's boom, and in no instance did my companions or self suffer from malaria or a chill. Before I became a resident of the State, my companions and self were unacclimated, and in no instance were we so foolish as to swallow quinine, arsenic, or alcoholic liquors as antidotes to malaria or chills. I speak from personal observation, experience, and extended inquiry in various portions of the State, and I unhesitatingly assert that the opinion entertained with regard to the prevalence of malaria during the cold months in Florida is unfounded. When discussing the advantages of Florida as a climatic resort, the eminent Dr. Forry predicted, "from a long residence in Florida, attached to the United States Army, that when the period of the red man's departure shall have passed, the climate of this land of flowers would acquire a celebrity as a winter residence not inferior to that of Italy, Madeira, or Southern France." *

"All know," remarks Dr. Brinton, p. 128, "how terribly arduous must be campaigning among the everglades of Florida, yet the yearly mortality from disease of the Regular Army there was only 26 per 1,000 men; the average of the Army elsewhere was 35 per 1,000, while in Texas it rose to 40, and on the Lower Mississippi to 45 per 1,000." If persons are suffering from malarial cachexia they may have chills at any season in any climate. But a few weeks since I was requested to visit a young lady visitor, whose home is Fifth Avenue, New York. The only time she had been dressed for three months was the day she was driven to the Savannah steamer. Upon inquiry I found that quinine, arsenic, and Warbeck's tincture had failed to cure her of chills. She arrived in this city in the latter part of February, and at the end of two weeks she departed for home, *sans* chills, *sans* malaria, *sans* debility. From my experience in hospitals and private practice in and near New York, I have no hesitation in stating that malarious diseases are more frequent there than in Florida. From my observations from Canada to the Gulf of Mexico, I am convinced that febrile diseases assume a milder form, and are more easily cured in Florida than in States to the north of it. I shall no doubt be met with the reply: "Look at the waxy complexions and gaunt forms of many Floridians, met with at some of the landings and depots." I admit the mild impeachment, and can attribute their cachectic condition to bad water, insufficient clothing, unsuitable and uncomfortable habitations, and the improper food they eat from childhood to the grave. In any other State but Florida they would be the victims of enlarged spleens, cardiac dilatation, chronic gastritis, tuberculosis, dropsical effusions, or albuminuria. But contrast the natives referred to with those who have comfortable homes, sufficient clothing, and who drink pure water and use good and nutritious food; or with Northern and Western people who have been in the State for years, and the latter will be found to be pictures of health. I admit that in Florida, as everywhere else, there are insalubrious localities, but they should be avoided by strangers. A majority of the cases of illness occurring among visitors in this State are referable to indulgence at table, drinking impure water, the inhalation of impure air, the American weakness of rushing hither and thither, occupation of unventilated rooms, and a ridiculous system of senseless drugging as a consequence of the advice given by physicians who are ignorant of the climate and its diseases.

From my observations in the United States and in foreign lands, and in hospital as well as in private practice, I have been forced to notice the infrequency of chronic disease and broken health in Florida. In my visits to various portions of this State I have met with many persons, old and young, who live from year to year on improper food, and who drink water from shallow holes, near marshes, and yet, singular to say (although such persons are somewhat anæmic), they do not present any manifest diseased condition. In cities, towns, villages, and rural districts, where residents are supplied with proper food and drink pure water, a case of chronic disease or broken health is seldom met with. And if we have a climate in which these conditions rarely occur, are we not justified in concluding that it will exert a powerful influence in restoring the invalid to health? I have, at various times, visited many portions of the State, and have been surprised to meet so many persons who have settled in it as invalids and have been restored to health or comparative comfort by the climate—a large proportion of them having been sufferers from pulmonary diseases. And what surprised me most, was the fact that none of their offspring manifested any constitutional predisposition to pulmonary disease.

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* Copeland's Dictionary of Medicine, vol. 1, p. 417.

GEOGRAPHY AND TOPOGRAPHY.

Florida is usually described as composed of East Florida, or that portion of the State between the Atlantic and the Suwannee River, comprising the whole of the peninsula; Middle Florida, extending from the Suwannee to the Apalachicola; and West Florida, comprising the territory west of the last-named river. This division, suggested probably by the existence of the distinctly-marked natural boundaries furnished by the rivers named, may be well enough for the purposes of a general description, but a different division suggests itself as better adapted to the purpose of an agricultural description of different sections, whose characteristic productions would be determined in the main by their special climatic conditions. Accordingly, in attempting to give that sort of practical information that would be serviceable to actual settlers, and best enable them to make satisfactory locations, a different mode of territorial division will be adopted, and for the purpose of properly grouping the counties with special reference to those climatic conditions which control and determine their vegetable productions, the State will be included in the three divisions of Northern, Central, and Southern Florida.

Northern Florida will be considered as constituted from all the lands lying north of the parallel of 30° north latitude; the territory included between the parallels of 28° and 30° north latitude will be styled Central Florida; and all south of 28° will be considered as composing South Florida.

Thus apportioned, a general account of each division will be given, accompanied by such local descriptions of the different counties as will convey a definite idea of the topography and characteristics peculiar to each.

NORTHERN FLORIDA.

This division extends from the Atlantic Ocean on the east, to Perdido River on the west, a distance of 375 miles, and has an average breadth of some 45 miles, and is composed of the counties of Escambia, Santa Rosa, Walton, Washington, Holmes, Jackson, Calhoun, Franklin, Gadsden, Liberty, Leon, Wakulla, Jefferson, Madison, Taylor, Hamilton, Suwannee, Columbia, Baker, Bradford, Nassau, Duval, Clay, and the northern part of Saint John's County.

The climate of this section as a whole may be said to be mild, verging upon warm. All extremes of temperature are essentially modified by the prevalence of daily winds from the ocean or Gulf of Mexico. The eastern portion, probably from the influence of the Gulf Stream, has a milder and more agreeable climate than that west of the Suwannee, and in winter suffers less from the cold northers and northwesters that occasionally prevail. But through the whole section so equable is the climate that although ice may be formed two or three times in the course of a year, the thermometer very seldom falls below 35° in the winter, or rises above 90° in the summer. There are occasional frosts, but during four-fifths of the winter season the prevalent temperature is that of the mildest Indian summer at the North and West.

The surface of Northern Florida varies from the somewhat tame and monotonous levels of Eastern and Western Florida to the undulating and uneven lands of the middle portion, and gives a much wider field for selection than is commonly supposed, although extreme elevations are entirely wanting. Many strangers, who only make a personal inspection of the Saint John's region, and go away complaining of the sameness of the scenery, the lack of variety in the landscape, and the sluggish movements of the streams, would find in the valley of the Saint Mary's a deep and somewhat rapid stream inclosed between picturesque bluffs and high banks in the midst of a rich and fertile territory. The same is also true of the Suwannee, the Chipola, and other rivers.

From Hamilton on the east and Holmes on the west, the intermediate section is undulating, and in some parts quite broken; many portions of Jackson, Gadsden, and Leon Counties, in particular, bearing upon their surface a strong resemblance to the less hilly portions of Pennsylvania, New York, and New England, and thus is afforded in Northern Florida a variety of surface, consisting of sandy plains and "flat woods," and an alternation of hill and vale, from which the divers tastes of different individuals can be easily gratified.

The soils of Northern Florida are as varied as is the surface. To the east is found a light and sandy soil, with a subsoil varying in depth, of clay or marl. In the west the poorer soils are sandy, while the better are loamy in character. In the middle, or section commonly called "Middle Florida," strong clay soils are often to be met, as is especially the case in Jackson, Gadsden, and Leon Counties.

It is undeniable that here, as in the State generally, there is a good deal of light and poor soil; but it is equally true that as rich and productive lands exist in Northern Florida, and when considered with reference to the value of the staple crops, as productive and valuable lands as can be found anywhere. The first year's crop of cotton and corn has in more than one instance repaid the purchase price of a plantation.

From the broken and uneven surface of the middle counties on the north, and from the comparative coolness of the climate, this division of the State is better adapted than either of the others to what is understood by ordinary "farming," as contradistinguished from "planting," so called. Hence there is a greater diversity of the crops usually raised in the Northern and Middle States than can ordinarily be found in the other divisions. Here, instead of depending mainly upon the avails of a single crop, as is usual with cotton, rice, and sugar planters, there is more of what is understood by the term of farming, and each cultivator aims at raising his own supplies as far as practicable; and cotton, corn, cane, wheat, rye, oats, hay, potatoes, and tobacco are often, and indeed commonly, made by each individual farmer.

The staple crops may be said to be corn, cotton, tobacco, rice, cane, Irish and sweet potatoes, and oats. The principal fruits are peaches, figs, grapes, oranges, though many others are raised. The apple and pear do not generally flourish, except along the Saint Mary's River (which is one of the best fruit regions in the whole South) and in the strong clay soils of Jackson, Gadsden, and Leon Counties. The peach and fig thrive everywhere and mature several weeks earlier than in the States lying north. The orange is grown throughout this division, the crop increasing in security as you go south; but very fine oranges are raised in the northern counties, although, when young, they should have some protection. No better oranges are raised in Florida than those produced in Liberty, Calhoun, Wakulla, and Washington Counties, and the world can show no better oranges than the best raised in this State.

This whole division is remarkably well watered. In addition to the numerous rivers—the Perdido, Black Water, Escambia, Econfina, Apalachicola, Chipola, Ocklockonee, Ancilla, Suwannee, Saint John's, Saint Mary's, and Nassau—and the multitude of smaller streams, nearly the whole region is abundantly supplied with springs, while good water is easily obtained in wells of little expense.

The timber of the region is abundant. The supplies of pine and cypress are apparently inexhaustible; while hickory, oak, ash, cedar, magnolia, and red bay are found everywhere. Game and fish are found everywhere in good supply. On the coasts, oysters and turtle abound. They are both abundant and good on the east coast; but the oysters of Saint Andrew's Bay, on the west, are not surpassed for size and flavor, and are exceedingly abundant.

So much will suffice for a general description of Northern Florida as a whole, and for more particular information reference is made to the local descriptions of each county in this subdivision, arranged in alphabetical order.

BRADFORD COUNTY.

Bounded north by Baker County, east by Clay, south by Alachua, and west by Columbia County. Area, about 600 square miles. The surface mostly level, but sufficiently high and undulating for cultivation. The soil varies from light to strong pine land, and is covered, where not improved, with a heavy growth of pine timber. This timber and naval stores are largely exported. The Atlantic, Gulf and West India Transit Railroad, which runs from Fernandina, on the Atlantic, to Cedar Keys, on the Gulf of Mexico, runs southwest across the eastern border of the county. This is a progressive county, and has a thrifty population of old and new settlers. All the usual crops do well, and the orange groves look as well as in any section; market gardening is also profitable here.

Lake Butler is the county seat, though Starke is the largest, both in population and business, and is situated directly on the line of the railroad.

BAKER COUNTY.

Bounded north by Georgia, east by Nassau and Duval Counties, south by Bradford, and west by Columbia County. Area, about 500 square miles. Its topography, soil, and general characteristics are similar to Bradford County. Mostly level, heavily timbered; soil, where cultivated, productive. The Central Railroad runs through the county from east to west, furnishing easy transportation to Apalachicola River on the west, to Jacksonville and Fernandina on the east, and connecting with the railroad system north. Sanderson, on the line of the railroad, is the county seat. Many small farmers are settling in this county.

COLUMBIA COUNTY.

Bounded north by Georgia, east by Baker and Bradford Counties, south by Alachua, and west by Suwannee and Hamilton Counties. Area, about 864 square miles. Its soil includes pretty much every variety found in Florida. The surface is generally level; the southern portion well timbered: the western part, high rolling pine lands of good quality; very little waste land unfit for cultivation. There are twelve lakes of moderate size, Alligator Lake being the largest; all abound in good fish. Muck, marl, limestone, sandstone, and clay suitable for bricks are found. Several streams afford good mill sites, and at Suwannee Shoals, on border of Hamilton County, there is sufficient water for large manufacturing establishments.

The railroad from Jacksonville runs through the county from east to west, with a depot at Lake City. Lake City, the county seat, is a neat place, surrounded by lakes; is the center of a well-settled agricultural country, and does a large commercial business. Besides cotton, cane, rice, tobacco, corn and root crops, raising vegetables for shipment to North and West is becoming a large industry. Orange and grape culture is receiving special attention, with best results. Some of the largest vineyards in the State are in this county.

CLAY COUNTY.

Bounded north by Duval County; east by Saint John's River, which separates it from Saint John's County; south by Putnam, and west by Bradford County. Area, about 425 square miles. The county is well watered, sufficiently high and uneven to afford water-power on several streams. Black Creek traverses the county, and is navigable for river steamers to Middleburg, the center of the county. The Atlantic, Gulf and West India Transit Railroad crosses the northwestern township of the county, about twelve miles from the head of navigation on Black Creek, so the county has excellent facilities to reach markets by water or rail. There are several fine lakes in the southwestern portion of the county, which afford, at all seasons, an abundance of food fish. Lake Kingsley is the largest, in the near vicinity of which, and in the section lying between the lake and the railroad, settlements and improvements are being rapidly made. Most of the soil of this county produces well all the staples of the country, and the usual vegetables and varieties of fruit. Bordering the many streams and lakes there are rich hammocks. The land, where not opened, is well covered with pine. Marl beds of large extent are found, and on Black Creek fine stone for building purposes. Middleburg, formerly the county seat, a town once of considerable importance, at head of navigation, was formerly the place of transshipment to and from the interior. The building of the railroad from Fernandina has diverted this. The county seat, Green Cove Springs, on the Saint John's, is a thriving place, and a great resort both for winter travelers and others who seek benefit from the sulphur spring, which is large.

CALHOUN COUNTY.

Bounded on the north by Jackson County, east by the Apalachicola River and Franklin County, south by the Gulf of Mexico, which, with Washington County, forms the western boundary. Area, 670,000 acres. Lands in the northern part are elevated and rolling; in the southern portion level, and in some places low. The Apalachicola River is navigable for large steamers, and the Chipola River, which nearly bisects the county from north to south, is navigable a portion of the year. Other streams abound and afford ample water-power, which is used, whenever desired, to advantage. Chipola Lake, 16 miles long and from 1 to 3 miles wide, is situated near the center of the county, and is full of fish of many kinds; the forests abound in game. Very extensive beds of marl, some quarries of stone, and clay suitable for brick are found in this county. Cotton, sugar-cane, corn, and peanuts, are the principal crops raised, as also vegetables and root crops. Orange culture is rapidly extending, and successfully. Stock-raising is carried on to some extent, and profitably.

DUVAL COUNTY.

Bounded north by Nassau County, east by the Atlantic Ocean, sou by Saint John's and Clay Counties, west by Baker and Nassau. It h an area of about 860 square miles, embracing the mouth of the ma nificent Saint John's River, the natural outlet of nearly a thousand mil of inland navigable waters. While the lands as a whole are not as ric in an agricultural sense as some other sections, yet there are to be foun ge and small tracts of rich hammock. Most of the land, however, t, but the modifying influence of the waters of the ocean and th broad Saint John's and other streams are favorable for crops, and especially for vegetables and fruit. Add to this the commercial facilities of river navigation, outward to sea and interior, the railroads connecting north, west, and south with the great through lines, and Duval County offers the very best advantages for general Southern crops, and particularly for large and small fruit growing and market gardening, which is rapidly extending. The light lands respond quickly to fertilizers, and marl, shells, and muck are found within easy distance.

Jacksonville, the county seat, is in the center of the county, and is the largest and most thriving city in East Florida, and in the very near future may rank in commercial importance with Savannah and Charleston. It is healthy, has many fine hotels, a complete system of water supply, thorough sewerage, rigid sanitary and police regulations, and is every way progressive. The Jacksonville, Pensacola and Mobile Railroad, the Savannah and Florida, and the Fernandina Railroads intersect the Saint John's River at this point, and the Jacksonville, Saint Augustine and Halifax River Railway is in process of construction. Arrangements have also been made for building a railroad from this city to Key West, touching at Palatka, Titusville, Tampa, and Punta Rassa. Steamers ply to Savannah and Charleston, connecting at those points with steamers to the principal Northern ports. Lines of schooners run regularly to New York.

ESCAMBIA COUNTY.

This county forms the west end of the State. Bounded north and west by Alabama, east by Santa Rosa County, and south by Gulf of Mexico. Perdido Bay and River separate it from Alabama on the west, Escambia River and Bay from Santa Rosa County on the east. That portion of the county bordering the Gulf is level, with a light soil, covered with pine; where this has been cut off, oak, hickory, bay, magnolia, and other hard woods have succeeded. The northern part, being over two-thirds, is uneven and hilly, and clay subsoil is near the surface, occasionally cropping out. The area of the county is about 600 square miles.

Pensacola is the county seat, and one of the most beautifully located and important cities in the State. Pensacola Bay has no equal in the Southern States, and in capacity, depth of water, and safety is not excelled by any Northern port. There is a large and well-equipped United States navy-yard, dry-dock, and coal-depot, as also Fort Barrancas, Fort Pickens, and the old Fort McRae. The recent extension of railroads to Pensacola, connecting it with the great through lines west, north, and east, will make it a great shipping port for products of field, mines, and manufactures. Escambia River is navigable for steamboats for twenty-five miles, and the Perdido for same distance. A railroad connects Perdido Bay with Pensacola Bay.

FRANKLIN COUNTY.

Bounded on the north by Liberty and Wakulla, east and south by the Gulf of Mexico, and west by Calhoun County. It is divided by the Apalachicola River, and includes Apalachicola Bay, Saint George's Sound, and the adjacent islands. It contains about 600 square miles, and was formerly one of the most thriving and important counties of the State. Apalachicola, the county seat, was formerly a place of large commerce; the lines of railroad from Atlantic cities west have almost entirely diverted the trade, and from being one of the largest cotton ports of the South, it has become only the port for a limited area of country. But with a fair port on the Gulf, and steamboat navigation reaching into Georgia and Alabama, by the Apalachicola, Chattahoochee, and Flint Rivers, there is a good prospect of its future growth as the country becomes settled. Many portions are rich, alluvial bottoms, very productive. All the Southern staples are successfully cultivated, and the orange and semi-tropical fruits fully equal, in growth, quality, and quantity, those of other sections. The bays and waters of the Gulf afford superior fish and oysters, and yield abundantly.

GADSDEN COUNTY.

Bounded north by Georgia; east by Leon, from which it is separated by the Ocklockonnee River; south by Leon and Liberty; west by Jackson County, from which it is separated by the Chattahoochee River. It contains an area of over 450 square miles. The surface is uneven, elevated, and presents a strong contrast with the more level lands on the Atlantic and Gulf coasts, the topography and soil in many portions resembling the northern parts of Virginia. It is one of the best-watered portions of the State; clear running streams and springs of freestone water are met with at short intervals, in every direction, which afford water-power for manufacturing. The soil is mostly based on red clay, lying from a few inches to two feet beneath the surface; the lands being rich, productive, and durable, are thus adapted for the growth of grain and forage crops, also cotton and cane. Previous to the war, this county was noted for its production of superior tobacco, which equaled Cuba tobacco in quality and price. The export previous to 1860 was 400 boxes of 400 pounds each of tobacco, annually. It is among the richest agricultural counties in the State, and has little waste land, and a larger proportion under cultivation than most others.

Quincy, the county seat, is a beautiful town, its location on high elevation affording fine views of the surrounding country. The Jacksonville and Mobile Railroad crosses the county from east to west to the Apalachicola River, thus affording good facilities for transportation to the North and West as well as to Eastern and Southern ports. Beds of marl are found in this county, as also clay suitable for brick.

HAMILTON COUNTY.

Bounded north by Georgia, east by Columbia, south by Suwannee, and west by Madison County. Area about 400 square miles. The Suwannee River forms its southern and eastern boundary, the Withlacoochee River its western, the Alapaha River dividing in nearly in the center. The Savannah and Gulf Railroad crosses from south to north, nearly in the center of the county. The general surface is rolling, soil light in some portions, with fine hammocks near streams. Jasper is the county seat.

HOLMES COUNTY.

Bounded north by Alabama; east by Jackson, from which it is separated by Holmes Creek; south by Washington and Walton; west by Walton County. Area over 500 square miles. The Choctawhatchie River runs south through the center of the county, affording steamboat communication with the Choctawhatchie Bay and the Gulf. Stock-raising, cotton-growing, and farming the principal business; sugar-cane, corn, potatoes, and other food crops raised for sale and home consumption. The land is mostly level, good pine lands, well timbered, varied by rich hammocks. The great need of this and adjoining counties is railroad communication. The Pensacola and Mobile Railroad will pass through this county at or near Cerro Gordo, the county seat, which is pleasantly situated on the high banks of the Choctawhatchie. A railroad is in process of rapid construction that will connect the county with Pensacola and Jacksonville.

JACKSON COUNTY.

Bounded on the north by Alabama; east by Decatur County, Georgia, and Gadsden County, Florida, from which it is separated by the Chattahoochee and Apalachicola Rivers; south by Calhoun and Washington Counties, and west by Washington and Holmes Counties; has an area of 1,000 square miles. It is considered as one of the richest agricultural districts of the State. Lands are rich, undulating hammock; soil composed of clay, loam, and lime, in various proportions, and pine lands of good quality of soil. The Chipola River, rising in Alabama, flows south nearly through the county, emptying into the Apalachicola; is navigable for boats of moderate draft. At a small expense the river could be made navigable for steamboats. The Apalachicola and Chattahoochee Rivers, on the eastern boundary, afford transportation to markets. The county exports largely cotton and other agricultural products.

Marianna, the county seat, is a beautiful place, doing a large business; is located on the Chipola River, the lower valley of which is well adapted to orange-growing, as also other fruits; soil rich and remarkably exempt from frost. The extension of the Jacksonville, Pensacola and Mobile Railroad, now rapidly progressing, will afford facilities for communication east and west, which cannot fail to render the county attractive for immigrants and capitalists.

JEFFERSON COUNTY.

Bounded north by Georgia; east by Madison and Taylor, from which it is separated by the Aucilla River; south by Taylor County and the Gulf of Mexico; west by Wakulla and Leon. Has an area of about 550 square miles. It occupies a central portion in the tier of counties known as Middle Florida, and offers many and substantial inducements to immigrants, especially to those who seek homes where they can enjoy all the benefits of civilization and the facilities for easy and cheap communication with markets. The face of the county, from the Georgia line south for about 20 miles, is beautifully undulating, intersected throughout with small streams fed by springs, and dotted here and there with beautiful lakes, prominent among which is the Miccosukie, which extends into Leon County and is 15 miles long by from 1 to 4 miles wide. The southern portion of the county is mostly flat woods. The soil is varied—in the upper and middle are stiff, red lands, with clay subsoil; on the Aucilla River and bordering on the flat woods are rich hammocks. It has a larger proportion of cultivated lands than other counties, and is among the largest cotton-producing counties. With Madison, Leon, and Gadsden it constitutes what is known as the rich agricultural district of Northern Florida.

The Jacksonville, Pensacola and Mobile Railroad crosses the county near the center, with a branch to Monticello, the county seat, one of the most healthy and delightful villages in the State.

LEON COUNTY.

Bounded north by Georgia, east by Jefferson County, south by Wakulla County, and west by Liberty and Gadsden Counties, from which it is separated by the Ocklockonnee River. It contains an area of about 700 square miles. The surface of the county, like that of the adjoining counties, which constitute what is known as Middle Florida, is varied; the northern portion uneven, the southern more level and interspersed throughout with clear-water lakes, among which are Lafayette, Jackson, Iamonia, Bradford, and the Miccosukie, extending fron Jefferson County, all abounding in fish. The soil is as varied as the surface. In the northern half of the county it is rich loam, based upon red clay, very productive. In the southern portion the soil is lighter, the clay lying deeper and of a pale yellow color. Leon is the center of the rich agricultural counties of Northern Florida, and no district of the same extent in the country can offer superior inducements to cultivators of the soil. Short staple cotton has been the principal source of reliance, but wheat, corn, rice, rye, oats, sugar-cane, tobacco, and all the diversified products of a rich agricultural district are successfully cultivated, and all kinds of stock raised with profit. Whether we consider its unexceptionable climate, the beauty of its undulating surface, the variety, abundance, and value of its timber, the fertility of its soil, with its adaptability to such a vast catalogue of crops, its accessibility to markets. its abundance of good, pure water, its general healthfulness, the ease with which the soil is cultivated, the intelligence and character of its people, the number of its laboring population, or the cheapness of its lands, no portion of the State or the country can offer superior inducements to immigrants.

The beautiful city of Tallahassee, the county seat and capital of the State, lies near the center of the county. The Jacksonville, Pensacola and Mobile Railroad crosses the county from east to west, and the Tallahassee Railroad, from the port of Saint Mark's, on the Gulf, intersects it at the capital. The name Tallahassee, signifying *beautiful land*, was applied by the Indians to this region of country, and was properly appropriated to designate the capital at the time of its location.

LIBERTY COUNTY.

Bounded north by Gadsden; east by Leon and Wakulla Counties, from which it is separated by the Ocklockonnee River; south by Franklin; west by Calhoun, from which it is separated by the Apalachicola River. It contains an area of about 850 square miles. It is sparsely populated, and little of its area is cultivated. Its characteristics are the same as Calhoun and Franklin. Cattle-raising is the principal business, but the ordinary staples of the State are successfully cultivated; orange culture is receiving attention, and fine groves attest the success of this important product. Bristol is the county seat.

MADISON COUNTY.

Bounded north by Georgia; east by Hamilton and Suwannee Counties from which it is separated by the Suwannee River; south by Lafayette and Taylor, and west by Jefferson, from which the Aucilla River separates it. It contains 750 square miles, and forms a portion of the rich agricultural district of Middle Florida. The lands are generally undulating, and some portions even hilly; a small part of the south-eastern portion is flat. The western half is very fertile, the eastern generally pine lands of fair quality and interspersed with lakes and ponds. The better lands are generally underlaid with clay, and the soil rich and generous. Long and short staple cotton have formed the chief product for exportation, and as high as 12,000 bales have been produced in a year. Now, while cotton continues the principal staple, the products are becoming more diversified, and grass, grain, sugar cane, and vegetables are receiving more attention and are found remunerative, while stock-growing and fruit culture are successfully prosecuted. A larger proportion of the lands of Madison County are under cultivation than of any other county.

Madison, the county seat, is a thriving place near the center of the county, on the Jacksonville, Pensacola and Mobile Railroad, which crosses the county from east to west. One of the largest lumber manufacturing establishments in the State, employing a capital of over $300,000, is situated in the eastern portion of the county; $30,000 are invested in grist-mills.

NASSAU COUNTY

Occupies the northeast corner of the State, and is bounded north and west by the Saint Mary's River, which separates it from Georgia, east by the Atlantic Ocean and Duval County, and south by Duval. It contains about 600 square miles, including Amelia Island, upon which the city of Fernandina, the county seat, is located. The soil of Nassau County varies from the light mulatto soils of the coast, through all the intermediate gradations, to the stiff clays and marls in the lowlands of the rivers, and its range of productions is as varied as the soil. On Amelia Island, the edge of the mainland, and scattered along her rivers, are soils of calcareous sand, that are adapted for the finest qualities of long staple cotton, and the culture of the peach, grape, olive, and orange, while the fresh marsh and black rush lands attached to them are especially suitable for gardening. These lands are easily reclaimed, rich, moist, and close to shipping opportunities, so that the shipping of early vegetables to Northern markets forms a profitable industry. The clay bluffs along the Saint Mary's River, and the so-called sand hills in the northwestern corner of the county, form a third distinct body of agricultural lands. The balance of the lands of the county are pine barrens, mostly sandy, and interspersed with numerous "bay-galls," cypress ponds, and savannas. The harbor of Fernandina is the northern terminus of the Atlantic, Gulf and West India Transit Railroad, from Cedar Keys, and is one of the best harbors for sea-going vessels of deep draught south of Norfolk, admitting of the safe anchorage of several hundred vessels at once, and with an entrance easy of access, and giving from 14 to 20 feet of water.

SAINT JOHN'S COUNTY.

Bounded north by Duval, east by the Atlantic Ocean, south by Volusia, and west by Putnam and Clay Counties, from which it is separated by the Saint John's River. It contains 970 square miles. The general surface is level, and the land is not of the first quality, being mostly flat pine woods and palmetto scrub, with some hammock; but its location, between the Saint John's River and the Atlantic Ocean, renders it more exempt from frost and better adapted to fruit culture than more interior counties in the same latitude. Orange culture and fruit and market gardening are now commanding attention, while stock-growing, corn, rice, sugar cane, &c., are profitable branches of agricultural industry. The Matanzas and North Rivers lie parallel with the coast on the east, and the Saint John's River and Lake Crescent on the western border.

Saint Augustine, the oldest city on the continent, rich in historic interest, and once famous for its orange groves, from which for nearly a century the nobles and grandees of Spain derived their best supply, is the county seat, and a port of entry for sea-going vessels, and is connected with the Saint John's River by railway to Tocoi, and a railway direct to Jacksonville is in process of construction. It is proverbial for its healthy and delightful climate, and is a popular resort, both summer and winter, for visitors seeking health and recreation.

SUWANNEE COUNTY.

Bounded on the north by Hamilton County, east by Columbia, south by Alachua and La Fayette, and west by La Fayette and Madison, from which, with Hamilton on the north, it is separated by the Suwannee River. Its area is about 700 square miles. This county occupies nearly a central position, from east to west, in the State, and the Suwannee and Santa Fé Rivers form its boundary on three sides, a distance of over 100 miles. These streams are navigable for steamboats to the southeastern part of the county. The general topography is rolling. The soil is sandy, in some parts mixed with a clay subsoil. Beds of marl, shell, and white clay fine enough for pottery. Limestone and sandstone abound, the latter white as marble, and, when first exposed, so soft that it may be cut into any desirable form, and becomes hard with exposure. Lumbering and naval stores form the leading industry, as the timber is very fine. The Jacksonville, Pensacola and Mobile Railroad crosses the county from east to west, and is intersected from the north by the Savannah Railway at Live Oak, the county seat, which is now in process of extension south, with Tampa and Charlotte Harbor as the objective points.

SANTA ROSA COUNTY.

Bounded north by Alabama, east by Walton County, south by the Gulf of Mexico, and west by Escambia, and contains about 1,600 square miles of territory. The surface and soil and the natural productions are very nearly like those of Escambia, which joins it on the west. Lumbering is the principal business, and agriculture has received little attention. The country is well watered, the Escambia River and Bay form its western boundary, and Pensacola Bay and Santa Rosa Sound lie upon its southern, while the Yellow, Black Water, and Clear Water Rivers and various creeks divide the interior of the county and discharge their waters into Pensacola Bay. Milton, located at the head of the bay and at the mouth of the Black Water, is the chief town and county seat. A large foreign export trade in lumber and timber has long been conducted from this port.

TAYLOR COUNTY.

Bounded north by Madison County, east by La Fayette, south by the Gulf of Mexico, west by the Gulf and Jefferson County; and has an area of 1,300 square miles. The Aucilla River enters the Gulf on its western boundary, and the Isteenhatchie on the eastern, while the Econfina, Finholloway, and Warrior lie intermediate. There are several sulphur, iron, and chalybeate springs. The surface is generally level, the lands are pine and hammock, and toward the Gulf coast are comparatively poor. The streams abound in fine fish, the coast in oysters, and the forests in game. It is a fine range for cattle, and stock-growing is the leading business; though cotton, corn, sugar cane, and tobacco for home use are produced by the farmers. Perry is the county seat.

WAKULLA COUNTY.

Bounded on the north by Leon, east by Jefferson, south by the Gulf of Mexico, and west by Franklin and Liberty Counties, from which it is separated by the Ocklockonnee River. It has an area of about 650 square miles. The surface is generally level, though sufficiently undulating for drainage. The lands vary from light pine to the richest hammock, and are intersected by streams, the most important of which are the Saint Mark's, Wakulla, and Sopchoppy. There are numerous springs—sulphur, chalybeate, and pure water. The sulphur springs at Newport, in the eastern part of the county, were formerly a popular resort for invalids, and the famous Wakulla springs, whose transparent waters create the sensation, while floating on its surface, of being suspended in the air, forms one of the most wonderful and attractive features. The port of Saint Mark's, at the mouth of the river of that name and the terminus of the Tallahassee Railroad, was formerly a place of considerable commercial importance; the construction of the various lines of railway from the Atlantic ports has diverted this trade. The streams abound in fish, and the coast in oysters, and with the facilities for communication with the markets of the world there are abundant inducements for settlement and cultivation. Stock-growing and agriculture are the leading industries.

Crawfordsville is the county seat, and is near the center of the county, and in a fertile and productive portion. The extension of the railway, now in progress, will soon afford communication east and west with the railway system of the country.

WALTON COUNTY.

Bounded north by Alabama and Holmes County, east by Holmes and Washington, south by the Gulf of Mexico, and west by Santa Rosa County. It embraces an area of about 1,800 square miles. The county was first settled in 1823, by a colony of Scotch families, who located in Uchee Valley, and whose decendants still possess the land. The lands of Walton County are principally pine; along the eastern boundary much of the soil is light, but there are exceptions, notably on the Choctawhatchie, where there is a tract 15 miles long by 4 miles wide of exceeding fertility. In the Uchee Valley is another tract of rich land, with clay subsoil, of about the same extent. Along the eastern and southern boundaries water communication with the Gulf of Mexico is furnished by the Choctawhatchie River and Bay, both navigable for steamboats, while the interior is watered by numerous creeks and runs, some finding their way into the Choctawhatchie, and others passing west into Pensacola Bay. The Jacksonville and Pensacola Railroad will cross this county.

CENTRAL FLORIDA.

This division is made up of the territory lying between the parallels of 28° and 30° N. latitude, and is composed of the counties of La Fayette, Alachua, Levy, Marion, Putnam, Volusia, Orange, Sumter, Hernando, and the southern portion of Taylor, Clay, and Saint John's Counties.

The surface of this division is less-broken, and, as a whole, more level than Northern Florida. It has more of savanna and marsh, and is bountifully supplied with water, having the Stinhatchie, Suwannee, Santa Fé, Withlacoochee, Crystal, Hillsborough, Acklawaha, and Saint John's Rivers, and is profusely studded with ponds, lakes, and smaller streams. The climate is very perceptibly milder, not only from its more southern geographical position, but the narrowness of the peninsula here, giving an average breadth between the ocean and the Gulf of only about ninety miles, exposes it to the daily sweep of the winds from either side, and by this means the extremes of both heat and cold are very essentially modified and ameliorated. The exposure to daily winds from each side increases, also, the rain supply, so that this division has more frequent and abundant rains, and suffers less from drought, than the northern division.

The soils of Central Florida are similar to those of Northern Florida, with a large proportion of hammock and savanna, and are perhaps of better quality, as a whole. Levy, Hernando, Alachua, Marion, and Sumter Counties, taken together, form a body of land that for productive capacity is not excelled by any similar body in the United States.

The staple crops are similar to those of Northern Florida, but the peculiar adaptability of this division to the cultivation of the sugar cane and all semi-tropical fruits has caused cane to advance rapidly of late in the estimation of farmers, and within a few years it will probably become the leading agricultural production. The sugar cane in this division ratoons for six or eight years in succession without protection, and often attains a height of from 10 to 15 feet, even when grown for a number of years on the same land without manure.

Particular attention is asked to the statistical return of crops in Hernando County, which is appended, and which, with other facts given, fully sustains the assertion that Central Florida is the best cane region in the United States, and probably in the world.

The entire division is the natural habitat of the whole citron tribe; numerous groves of the wild orange have been found and still occasionally appear, and, as would naturally be anticipated, the orange, lemon, and lime are natural and very prolific and profitable crops. The peach and the fig thrive everywhere; the guava and the banana do well without protection; and the pine-apple is cultivated, although it does not flourish as in South Florida. Irish and sweet potatoes, melons, and all kinds of garden vegetables are cultivated with great success, and can be brought to maturity at almost any season, at the option of the cultivator.

ALACHUA COUNTY.

Bounded north by Suwannee, Columbia, and Bradford Counties, from which it is separated by the Santa Fé River; east by Clay and Putnam; south by Marion and Levy; and west by La Fayette County, from which it is separated by the Suwannee River. It has an area of over 1,300 square miles, and embraces almost every variety of lands found in the State, from the richest hammock, high rolling pine, hickory, and oak, to the more level, heavy timbered pine lands. Its elevation above the sea is from 50 to 250 feet; it has numerous lakes and streams, which afford good water-power and abound in excellent fish. Lake Santa Fé, in the northeast portion of the county, is believed to be the highest body of water in the eastern portion of the State, being on the ridge from which waters flow to the Atlantic Ocean on the east and to the Gulf of Mexico on the west.

The Atlantic, Gulf and West India Transit Railroad runs directly through the county, from the northeast to the southwest, entering the county near Santa Fé Lake. The Peninsular Railroad intersects it at Waldo, a growing and thriving town in the northeastern portion of this county, and runs nearly due south to Orange Lake, some twenty miles, and is being extended to Ocala and thence to Tampa Bay, on the Gulf. A canal is nearly completed from Waldo, connecting with railroad, and also connecting Lakes Alto, Santa Fé, and smaller lakes, opening up a large area of excellent lands to easy access.

Gainesville, the county seat, is one of the most progressive towns in the State, both in population and business. The population of the county is increasing from year to year, and the agricultural and horticultural resources are developing more and more each season.

The fruit and vegetable industry, only as yet in its infancy, has already assumed large proportions; 450,000 packages alone were shipped over the railroad the past season. The staple crops are, long-staple and upland cotton, sugar cane, rice, corn, root crops, vegetables of all kinds, oranges and other semi-tropical fruits. This county was early selected by the pioneer settlers as one of the best in the State, and time has proved the wisdom of their choice. From the northwest to the southeast a peculiar limestone formation is found, the crust in many places having, from some cause, sunk down; these depressions are generally more or less full of water, and connected by subterranean waters; these sinks are oval and conical downwards, and from 10 to 40 feet

HERNANDO COUNTY.

Bounded north by Marion and Levy; east by Sumter, being separated from these counties by the Withlacoochee River; south by Hillsborough County; and west by the Gulf of Mexico. Its area, over 1,600 square miles, fronts on the Gulf 60 miles, extending from the mouth of the Withlacoochee south to Anclote River, embracing Crystal, Homosassa, Cheseehowiska, Wekiwachie, Pithlochascotee, and Anclote Rivers, which vessels of ordinary draft can enter.

No county in the State has a more varied topography, or greater advantages for the successful prosecution of agricultural and horticultural pursuits, or is so attractive for a residence.

Lands high and rolling, like the red hills of Northern Georgia; high, smooth tracts of pine lands; extensive hammocks of the richest soil; frequent marl beds; limestone; large springs of the purest water; lakes and rivers abounding in fish; a long coast with frequent harbors; the bays and Gulf always afford fish, oysters, and sponge; a climate and soil adapted to cultivation of cotton, cane, rice, tobacco, corn, oats, grass, and vegetables, having peculiar advantages for growing the olive, the different varieties of the citrus, the pine-apple, guava, banana, and all the semi-tropical fruits. Transportation is year by year becoming more rapid and cheap, and access to and from markets easier. Immigration, enterprise, and industry will make it one of the most prosperous and desirable portions of the South. The county seat is Brooksville.

LEVY COUNTY.

Bounded north by Alachua, east by Marion, south by Hernando and the Gulf of Mexico, and west by the Gulf and La Fayette County, from which the Suwannee River separates it. It has an area of over 1,000 square miles. The surface is generally level, being mostly flat pine wood land. The Gulf hammock, a tract of land of great fertility, of some 100,000 acres, capable of producing sugar cane equal to Louisana bottoms, occupies the southern portion of the county. The Suwannee River enters the Gulf on the western boundary, the Withlacoochee on the southern, with the Wacasassa about midway between. The Atlantic, Gulf and West India Transit Railroad runs from northeast to southwest through the county, near its center, and intersects the Gulf at the harbor of Cedar Keys, where vessels find entrance, and freight and passengers are transferred from the Gulf steamers to the railroad, thus affording enlarged facilities for direct communication with the markets of the North and the ports of the Gulf. The county possesses peculiar advantages for the production of sugar cane and rice, besides the ordinary products of long-staple cotton, vegetables, semi-tropical fruits; and stock-growing forms a sure reliance for revenue. The waters on the coast abound in fish, oysters, and turtle, which are largely gathered for export to the interior.

Bronson, the county seat, is on the railroad, the centre of a well-settled portion of the county.

LA FAYETTE COUNTY.

Bounded north by Suwannee; east by Suwannee, Alachua, and Levy, from all of which it is separated by the Suwannee River; south by the Gulf of Mexico; and west by Taylor County. Contains an area of over 1,200 square miles. The land is principally heavy timbered pine lands, with many large tracts of hammock, a portion with a strong clay foundation and productive. The principal business is stock-growing and lumbering, but it is eligible for agriculture and fruit-growing, and the Suwannee, which skirts its eastern boundary, is navigable for steamers to New Troy, the county seat.

MARION COUNTY.

Bounded north by Alachua and Putman, east by Putman, Volusia, and Orange, south by Sumter and Hernando, and west by Levy County. Containing an area of 1,000 square miles. It is one of the largest, most fertile, productive counties of the State, especially in Sea Island cotton and sugar cane. The lands are generally elevated and undulating, and drain both to the Ocean and Gulf. There is very little poor and unavailable lands, the most being rich and productive. The pine lands are almost uniformly good, underlaid with clay, marl, limestone. The hammocks are extensive and very rich, and will equal the best lands of the Mississippi in producing. Sandstone for building purposes is in great abundance. The Ocklawaha River, a tributary of the Saint John's, and navigated by steamers daily, runs north across the center of the county. The celebrated Silver Spring forms a basin of two or three acres in extent near the center of the county; it pours forth a volume of water from one to two hundred feet wide, discharging into the Ocklawaha. Blue Spring, almost as remarkable, and not much inferior in size, lies in the northwestern portion of the county, and sends forth a stream of clear blue water into the Withlacoochee River, some twenty miles from the Gulf. Sulphur springs are numerous; the most noted is known as Orange Spring, in the northeastern portion of the county, which was formerly a great resort for invalids. Orange Lake, celebrated for the large orange groves on its borders, which are the most extensive of any in the State, occupying an area of over 1,000 acres, lies in the northern portion of the county, and is now connected by the Peninsular Railroad with the Atlantic, Gulf and West India Transit Railway at Waldo.

Lakes Churchill and Bryant, in the eastern, and the beautiful Lake Weir, in the southern part of the county, are the most prominent and attractive of the inland water of the county.

Ocala, the county seat, situated six miles from Silver Spring, is a growing business town. The Peninsular Railroad is completed to this place, from which it will be extended southward to Tampa and Charlotte

Harbor, on the Gulf of Mexico. The Florida Southern Railway from Palatka, on the Saint John's, and Gainesville, on the Fernandina Railway, is finished to this place, and is to be extended south to Tampa and Charlotte Harbor. The government lands as well as State lands are being rapidly taken up by homestead and purchase. No part of the State, or, in fact, the South, offers greater inducements for permanent location.

ORANGE COUNTY.

Bounded north and east by Volusia County, which is separated from it by the Saint John's River, south by Brevard and Polk, and west by Polk, Sumter, and Marion; with an area of 2,300 square miles. The county is generally high, rolling pine land, interspersed with clear-water lakes, bays, and hammocks. The rolling pine lands are of good quality and heavily timbered; soil dark gray loam, with sand on the surface, based upon yellow sandy loam, with a substratum of clay and marl. Portions are flat pine woods of less value. Some of the prominent lakes are Monroe, Jesup, Harney, Eustis, Apopka, Dora, Maitland, Butler, and Tohopekaliga. These lakes are from 3 to 50 square miles in extent. There are innumerable smaller lakes, with areas of from 10 to 1,000 acres. The shores are generally abrupt, rising in some cases to 70 feet above the water. Fish and game abound. Stock-growing has been the predominant industry until later years, with cotton, corn, and cane; but now fruit culture is absorbing general attention, and the orange, lemon, lime, citron, guava, pineapple, and banana, and every variety of Southern fruit, are extensively cultivated. No county in the State has increased in population and improvement so rapidly during the last ten years as Orange, and large accessions from the Northern and Western States, of refined, cultured, and wealthy citizens, are constantly being made. A railroad from Sanford, on Lake Monroe, the head of the larger class of steamboat navigation, to Orlando, the county seat, has been constructed, and is in process of construction south through the county, and to Tampa and Charlotte Harbor. The Saint John's and Lake Eustis Railway, from Astor, on the Saint John's, to Fort Mason, on Lake Eustis, has also been completed, an extension of which to Leesburg will probably be made. The industry, energy, and progressive spirit manifested in this county is of the character manifested in the North and Northwest, and cannot fail of ultimate success.

Population, 1870, 2,195; 1880, 6,190—white, 5,494; black, 696. Number acres land tilled, 13,166. Farm values, $3,381,410; farm implements and machinery, $52,040.

PUTNAM COUNTY.

Bounded on the north by Clay County, on the east by Saint John's, on the south by Volusia and Marion, and on the west by Alachua and Clay, and contains an area of over 800 square miles. The Saint John's River runs through the county for 30 miles, and skirts it on the east for remainder, affording means unexcelled for transportation. Lake George, a body of water about 10 miles wide by 20 long, is on its southern boundary, and Lake Crescent, of beautiful, clear water, 12 miles long, with high surroundings, occupies the southeastern corner, and connects with the Saint John's through Dunn's Creek. The Ocklawaha River crosses the southern portion of the county from the west, and enters the Saint John's opposite Welaka. The portion of the county lying east of the Saint John's, and extending to Crescent Lake, is called Fruitland Peninsula, and is rich and fertile. The western portion of the county is undulating, in sections slightly hilly, with a sandy surface soil and a red and gray subsoil, interspersed with fresh-water lakes, and for cotton and general farming is the best part of the county. The pine lands will produce 10 bushels of corn or 300 pounds seed cotton, and the hammock 20 bushels of corn and 600 pounds cotton per acre, without fertilizing. Nearer the Saint John's, generally speaking, the lands are less rolling and fertile, but heavily timbered. Many portions, however, of the soil are rich in humus and other products of vegetable decomposition. The lands are generally high enough for culture. Drayton Island, embracing 2,000 acres, and a part of the county, is famous for its rich soil and marl. The county contains nearly every variety of Florida soil—swamp lands, high and low hammock, heavily timbered with hickory, oak, and other hard woods, and the different qualities of pine land, clay, sand, marl, and shell. A number of the finest and oldest orange groves of the State are situated in this county. There are fully 5,000 acres in the county specially devoted to the cultivation of the orange. The fruit culture and vegetable production for Northern and Western markets form a leading and profitable business, while cotton, rice, sugar, corn, and other staples are a permanent reliance for agricultural industry. There are forty-three schools, twenty-one post-offices, and more than a dozen places in the county where considerable manufacturing and a large mercantile trade is carried on.

Palatka is the county seat, and one of the best business towns of the State, situate at the head of navigation for deep-draft steamers and sailing vessels, and near the confluence of the Ocklawaha. It possesses advantages which cannot fail of rendering it a fine commercial city. It has beautiful churches, good schools, a nunnery, and two or three of the largest hotels in the State. A narrow-gauge railroad from here to Gainesville, and thence to Ocala, has been completed, and is being extended to Tampa and Charlotte Harbor. Palatka is connected by telegraph with all parts of the country. At San Mateo, 6 miles south of Palatka, is an extensive orange-packing house, and the "San Meteo Institute," an excellent institution of learning, free in part.

SUMTER COUNTY.

Bounded north by Marion County, east by Orange, south by Polk, and west by Hernando, from which it is separated by the Withlacoochie

River, and has an area of over 1,300 square miles. The general characteristics of Sumter are the same as Orange, Polk, Hernando, and Marion Counties, by which it is surrounded. The Ocklawaha River connects the waters of Lakes Griffin, Harris, and Eustis, in the northeastern portion of the county, with the Saint John's; and Lake Pansofka, on the west, connects with the Gulf through the Withlacoochie. A chain of lakes in the southeastern portion of the county connects with Lake Harris through the Pilaklikaha Creek. On the east of these lakes a high rolling pine woods country extends for miles; on the west are fine hammock lands and grass lands for stock. The lands in the northern and western portion of the county also are exceptionally good, and orange-growing is the prevailing interest. The acres planted in orange groves are numbered by the hundreds, and the bearing trees by the tens of thousands. No county in the State is better adapted to fruit-growing, while stock-raising and the agricultural staples of the South afford a sure reliance for the profitable investment of labor and capital. Leesburg, located at the head of Lake Griffin and between that and Lake Harris, is the county seat. The Ocklawaha River is navigable for small steamers, and a railway extends from Lake Eustis to Astor, on the Saint John's River.

The Tropical Railway connects with Fernandina, and the Florida Southern with Gainesville and Palatka. Both are in process of construction south, with the view of completion to Tampa Bay and Charlotte Harbor.

VOLUSIA COUNTY.

Bounded north by Saint John's County and the Atlantic Ocean, east by the Atlantic, south by Brevard and Orange, and west by Orange County, from which it is separated by the Saint John's River. It contains about 1,800 square miles. The Saint John's River runs the entire length of its western border, and the Halifax and Hillsborough Rivers, or lagoons, traverse the entire eastern boundary, with only a narrow strip of land, formed by the winds and waves of the ocean, extending between them and the ocean. It is one of the most progressive and thriving counties in the State. The lands along the west bank of the Halifax and Hillsborough Rivers, four or five miles wide, are the richest hammocks, and were cultivated in sugar cane at a very early period by the English and Spaniards, the remains of whose extensive works still exist. It is said that four hogsheads of sugar per acre have been and can be still produced on these lands. West of this is a belt of prairie, interspersed with pine and cabbage palmetto, extending the entire length of the county, and affording magnificent grazing for stock. Next, further west, extending from the northern end of the county south about 30 miles, and varying in width from 2 to 6 or 7 miles, is a high rolling pine country, considered by many the best for orange culture, on which are hundreds of beautiful young groves; from this southward is a high rolling pine scrub, until the Saint John's is reached with its varying banks of rich hammock and savanna. Springs, lakes, and ponds abound all through the county. Enterprise, on Lake Monroe, is the county seat.

SOUTHERN FLORIDA.

South Florida, consisting of that portion of the peninsula south of latitude 28° north latitude, is composed of the counties of Hillsborough, Polk, Brevard, Monroe, Manatee, and Dade. From its low latitude, its peculiar location, as interposed between the Gulf of Mexico and the Atlantic Ocean, and its proximity to the Gulf Stream, this division has marked characteristics which specially distinguish it.

The surface is in the main flat, and, excepting the extension within its northern portion of the flattened ridge or plateau upon which the State is mostly situated, the greatest elevations found are around the external boundaries, while the depressions are in the interior, causing it to resemble the basin of a shallow lake. Thus constructed, and under the influence of the rain-bearing clouds from both sides, while the elevation of the exterior border prevents the easy egress of superabundant water, this division is not only well supplied with rivers, streams, and small lakes, but has also the broad, shallow lake of Okeechobee, and that remarkable receptacle of surplus fresh water, called the Everglades, within its borders, and occupying a large portion of its extent. It is quite probable that a clearing out of the obstructions formed in the channels of the numerous river courses reaching out from the interior to the Gulf and Ocean will relieve this section from overflow in the season of excessive rainfall, and reclaim a large territory of rich and most fertile lands, which, under the fostering influences of a climate of unsurpassed mildness, become exceedingly valuable for their immense productiveness in special crops. The savannas or grass prairies that are liable to periodical inundation during part of the year, but hidden with a rich growth of nutritious grasses during the balance of the time, form a characteristic feature of South Florida, and constitute some of the best cattle ranges in the world.

The climate is singularly equable and uniform, the difference between summer and winter being very slight, and the range of the thermometer during the year confined within very narrow limits. Warmer in winter and cooler in summer than any other portion of the State, the climate is equal to that of the most favored regions of the world, and nearly resembles that of the Sandwich Islands.

The crops in this section would not include the cereals grown with success in Northern Florida, and even corn is not grown with much success, while the apple, pear, and peach do not do as well; but, on the other hand, long-staple cotton, sugar cane, rice, jute, ramie, tobacco, indigo, cassava, arrowroot, coffee, the olive, grape, orange, lime, lemon, citron, almond, date, cocoanut, pineapple, banana, plantain, and all the semi-tropical and tropical fruits thrive as well as in any part of the world. The keys and islands which line the coast on either side, and vary in extent from a few acres to a number of square miles, are equally available for tropical products.

BREVARD COUNTY.

Bounded north by Orange and Volusia Counties, east by the Atlantic Ocean, south by Dade, and west by Orange, Polk, and Manatee Counties. It extends along the coast for 100 miles, and contains an area over 4,000 square miles. The famous Indian River extends along its eastern boundary, the Kissimee River and Lake forming its western boundary. The climate is even and pleasant through the year. Game is plenty, and green turtle, fish, and oysters abound. Stock-raising is largely pursued; the cattle having a good range, are of good size and in good condition. Along Indian River, the west bank of which is from 10 to 20 feet above the ocean, settlements are being made. Indian River has a reputation for its oranges and pineapples, and all semi-tropical fruits, which here grow in perfection. The county seat is Titusville, a thriving town on Indian River.

DADE COUNTY.

Bounded north by Brevard County, east and south by Atlantic Ocean, and west by Monroe County. Has an area of over 5,000 square miles. Lake Okeechobee, an inland sheet of water, of over 500 square miles, without any visible outlet to ocean or gulf, occupies the northwestern corner of the county, the famous everglades the largest portion of the remainder. Along the Atlantic coast there is a strip of elevated rocky pine lands, 3 to 15 miles wide, skirted by a prairie or savanna, from a half mile to a mile in width, reaching to the everglades. This rich alluvial prairie is covered with an immense growth of grass. The climate is very equable, the extremes being from 51° to 92°. From May to October rains are frequent; during the remainder of the year there is little rainfall. In the vicinity of Biscayne the land is covered with an undergrowth of comptie, which yields an excellent article of starch and farina, similar to arrowroot. Dade County is the least populous county in the State. Miami is the county seat.

The following detailed description of this county, and the section of the State adjoining, was furnished by Lieutenant-Governor Gleason, a resident of the county, and published in a State paper. It is of interest as conveying a definite idea of the local advantages of this entire portion of the State, extending from Jupiter Inlet to Cape Sable, including the keys and islands along the reefs and everglades:

> The keys are a series of islands extending along the south coast, from Cape Florida to the Dry Tortugas, lying between the mainland and the Florida Reefs, and within from 3 to 5 miles of the Gulf Stream. They are of a similar character, being of general formation and very rocky. Some are only a few acres in extent, while others contain as many as 15,000 acres. Cayo Largo is the largest. These keys are only a few feet above tide-water, and are principally covered with a growth of hard-wood timber, consisting of mastic, red and sweet bay, gumbo-limbo, crabwood, palmetto,

mangrove, and a variety of oaks. The land is too rocky to admit of general cultivation, but is well adapted to the growth of cocoanuts, aloes, sisal hemp, and pineapples, all of which seem to live on a rocky soil, and grow here with but very little attention. Between these keys and the mainland is Barnes' Sound and Biscayne Bay. Barnes' Sound and Card's Sound are interspersed with innumerable small keys, covered with mangroves, and are under water at high tides, and are the resort of snipe, curlew, and other birds. In both of these sounds and Biscayne Bay are great quantities of turtle and sponges of the finest and best varieties. The sponges and turtles taken from these waters exceed $100,000 in value per annum.

The bay and all the passages between the keys and the streams running into the bay from the mainland are well supplied with a great variety of fish, such as mullet, sheepshead, grouper, &c., while incredible quantities of kingfish and Spanish mackerel are caught on the border of the Gulf Stream.

Biscayne Bay is an excellent harbor for all vessels drawing less than 10 feet of water, and can be entered at all times. The everglades are a vast shallow lake, overgrown with grass, pond-lilies, and other aquatic plants, interspersed with innumerable small islands of from 1 to 100 acres each. These islands are principally hammock lands covered over with a growth of live and water oaks and cocoa plums, with an undergrowth of morning-glories, grapes, and other vines, and are extremely fertile. The water is from 4 inches to 4 feet deep, and is very clear and pure. In many places are channels and sinks where the water is from 10 to 50 feet deep; these holes are well supplied with fish, of which the trout is the most desirable. Alligators and turtle are abundant, and panthers, wild cats, and bears are quite numerous.

Flowers of the sweetest fragrance, and of every hue and color, greet the eye. The border and outer margin of the everglades is prairie of from one-fourth to one mile in breadth, and comprises some of the finest and richest land in America, having once been a portion of the everglades, and formed by the receding of the waters. The soil is sandy, with a mixture of lime and vegetable matter, and freely effervesces when brought in contact with acids.

The strip of land between Biscayne Bay and the everglades is from 3 to 15 miles in breadth, and is principally rocky pine land, with an undergrowth of a species of sago-palm, called by the Indians "koonitie," which name has been generally adopted by the whites. It makes a very good article of starch, and excellent gavini, which cannot be distinguished from Bermuda arrowroot except by microscopic tests.

This section of the country has evidently been an uplift or upheaval, as the rock dips at an angle of about twenty-three degrees, and slopes both toward the bay and the everglades. The rock, in many places, is in circular form, and is coral. The soil is sandy, which, mixing with the decomposed lime of the coral rock, forms an excellent and inexhaustible soil for grapes and sugar cane. The country north of Biscayne Bay, towards Jupiter Inlet, is of a similar character to that already described, with the exception that there is no rock. Fine springs of water are found in different localities, and burst forth with great force; some of these are mineral springs, principally chalybeate. Sea-island cotton is grown here, and it is a perennial, and can be picked several times each year. Grapes flourish well, and are not subject to mildew, and ripen about the middle of May. Tobacco raised along the bay will compare with the best of Cuba. Bananas, plantains, oranges, coffee, dates, pineapples, rice, indigo, sugar, apples, arrowroot, cassava, all grow and thrive, as well as the garden vegetables of the Northern and Middle States. Indigo, when once sown, remains in the ground and ratoons as it is cut off. Sugar cane ratoons, and requires planting only once from four to five years. Sugar cane can be raised here with less labor than in Cuba, as the land is easier cultivated, and a sugar plantation can be made for one-fifth of the money which it can in Louisiana.

This section of the State is capable of producing all the products of the West Indies, and there is no doubt that when this portion of the country becomes known it will be rapidly developed. Sea-island cotton can be raised with half the labor that is required in the northern part of this State or in South Carolina, as this is beyond the region of frost. The climate is very agreeable, being tempered by the Gulf Stream. It is not as warm here in summer as in New York, or as cold in winter as in Cuba, as there are no mountains or high elevations of land. The thermometer averages 73°, and the extremes are 51° and 92°.

There is a constant sea-breeze off the Gulf Stream, commencing about 8 o'clock a. m. and lasting until nearly sundown. The climate is very exhilarating, and a white man can do as much labor in a day as in any portion of the United States.

The constant Indian wars, which have been more severly felt in this county than in any other portion of this State, have retarded its growth and prevented its development. Biscayne Bay is within four days of New York, and is the best locality in the United States for raising vegetables and fruit for that market. All kinds of vegetables can be raised in the winter, and pineapples and limes are three weeks earlier at this place than in the Bahamas or Cuba.

HILLSBOROUGH COUNTY.

Bounded north by Hernando, east by Polk, south by Manatee County, and west by Gulf of Mexico. It contains about 1,500 square miles, embracing Clearwater Harbor, Tampa and Hillsborough Bays, with the Hillsborough, Alafia, and Little Manatee Rivers entering from the north and west, and many keys or islands on the coast. The land lies more level than in Hernando County, and though generally lighter, is still fertile. Tampa City, a port of entry situated at the head of Tampa Bay and mouth of Hillsborough River, is a thriving place, and the county seat. The citizens are enterprising, and the cultivated lands and orange groves in city and vicinity show constant progress. Cattle-raising for export has always been a leading business in this and adjoining counties. Large numbers are exported annually to Cuba. Recent immigration and increased population has led to very extensive cultivation of oranges and semi-tropical fruits and vegetables, for which there is no better section, as climate, soil, and transportation are favorable. Some tropical fruits have been successfully cultivated. The usual Southern staples of cotton, cane, and rice are raised, as also field crops of all varieties common to other sections. There are now five lines of railroads in contemplation, three of which are in process of rapid construction, from the Saint John's River and the Atlantic ports, with Tampa as the objective point.

MANATEE COUNTY.

Bounded north by Hillsborough and Polk; east by Brevard and Dade Counties, being separated from the latter by Lake Okeechobee; south by Monroe County, and west by the Gulf of Mexico; containing an area of over 5,000 square miles, and embracing the northern portion of Charlotte Harbor, the southern portion of Tampa Bay, Sarasota Bay, and the numerous islands adjacent. Peace Creek, rising in Polk County, subdivides the county near the center, and runs south to Charlotte Harbor, having numerous tributaries, which, with many lakes, water the interior of the county. The Myakka River discharges into the harbor further westward, and the Manatee River, in the northwestern part of the county, enters Tampa Bay. The surface is generally level, lands light, piney woods, hammocks, and prairie. Pine Level is the county seat.

Along the rivers and borders of lakes the land is very productive; a large portion of the country is given up to stock-raising, which is a leading and profitable business. Over 100,000 head subsist at no cost or care, except the gathering to brand and mark, or for sale and delivery. Key West, Cuba, and other is lands afford a constant and good market, and steamers and vessels are regularly engaged in the transportation, mostly from Tampa Bay and Charlotte Harbor. There are many stockmen who count their herds by the tens of thousands. Peace Creek, a large stream, is susceptible of steam navigation through the county, and is attracting immigrants, especially those who seek an equable climate, and to locate below what is called the frost-line. Long-staple cotton, cane, rice, tobacco, do well, and will become leading staples of export.

MONROE COUNTY.

Bounded north by Manatee, east by Dade, south and west by the Gulf of Mexico. It has an area of about 5,000 square miles, a large portion of which is occupied by what is known as the Big Cypress Swamp and the Everglades. The county includes the numerous keys and islands off the Florida southern coast, the most important of which is Key West, where the principal wealth and population are located, and the southern portion of Charlotte Harbor, Pine, Sanibel, and other islands. The Caloosahatchie traverses the northern portion of the county and enters Charlotte Harbor, and is navigable as high up as Fort Thompson, some 30 miles from its mouth. It is contemplated to connect this river with the great lake Okeechobee and drain the extensive country about the lake. The northern portion of the county is adapted to semi-tropical and tropical fruits, and also many of the keys, which are already famous for cocoanuts, pineapples, and bananas. Key West is the county seat.

POLK COUNTY.

Bounded north by Sumter and Orange Counties, east by Orange and Brevard, south by Manatee, and west by Hillsborough. The Kissimmee Lake and River separates it from Brevard. It has an area of about 1,900 square miles, and its general characteristics are the same as Sumter and Manatee. The surface is undulating, the lands hammock, pine, and prairie, dotted all through with small lakes of clear water abounding in fish. The prairies are the range for herds of cattle, of which there are 100,000 head in the county. Bartow, situated on Peace Creek or River, is the county seat, and a thriving business place. The lands within 2 or 3 miles of Peace Creek and its tributaries are excellent farming lands and well adapted to the culture of the orange and semi-tropical and some tropical fruits.

PRODUCTIONS OF FLORIDA.

Having thus presented a general survey of the climate, soil, and topography of the State, in which I have made free use of the material furnished through official publications and well-authenticated sources, I next proceed to consider the productions and agricultural capabilities of Florida. In this I shall avail myself of the practical experience of those who have labored to develope these resources.

So much has been said of the vast scope of vegetable growth in Florida that it is a cause of surprise to all strangers and suspicion to many, as though there might be well-grounded suspicion of exaggeration or overstatement. On this account it is deemed best to refer to some of the older standard writers on this subject.

In the "Observations" of Charles Vignolles, published in New York in 1823, on page 99, we find the following:

> The following list of productions capable of being raised in Florida has been made out with some pains, and it is believed all these stated are profitable and practicable articles:

Oranges, various kinds,
Lemons,
Lime,
Citron,
Shaddock,
Mango,
Pawpaw,
Cocoa,
Dates,
Sweet Almond,
Bitter Almond,
Pistachio,
Acuaqua,
Gum gleni,
Fustic,
Balsam,
Hemp,
Camphor,
Frankincense,
Leeche plant of China,
The olive,
The vine, all varieties,
Currants, Zante,
Pineapple,
Figs,
Plantain,
Banana,
Yam,
Bread-fruit,
Arrowroot,
Gallnuts,
Doliahos, or soy-lean,
Jalap,
Tree rhubarb,
Ginger,
Gum guiacum,
Braziletto,
Senna,
Turkey madder
Balm of Gilead,
Cloves,
Liquid-amber,
Aloe,
Cinnamon,
Pimento,
Sago palm,
Red pepper,
Saponica,
Jesuit's bark,
Besine,
Palma Christi, castor-bean,
Tea,
Sugar,
Tobacco,
Rice,
Cotton,
Silk,
Cork-oak,
Chestnut,
Sassafras,
Sarsaparilla,
True opium poppy,
Tumeric,
Nutmegs.

Such a list seems wonderful enough as attributed to a single State, but this list, made fifty years ago, is far from comprising all the products which may be profitably cultivated, or are within the capacity of this soil and climate.

Besides the staples common to more northern latitudes, cotton, wheat, rye, oats, peanuts, cow-pease, Irish and sweet potatoes, melons, and all the variety of garden vegetables, and the strawberry, blackberry, huckleberry, plum, pomegranate, and quince, we may add coffee, cassava, indigo, cochineal, Sisal hemp, the guava, tamarind, sapadillo, avocada pear, mamie-apple, custard-apple, pecan-nut, &c.

The year following the acquisition of the territory of Florida, 1822, a French gentleman, Peter Stephen Chazotte, presented to Congress a memorial setting forth the advantages of the climate and soil for tropical productions, and asking that the government allot one thousand acres of land in the southern portion of Florida, with an appropriation of $50,000, for the establishment of an experimental farm and the introduction and propagation of coffee, cocoa, and other products of tropical countries.

At a still earlier period, a proclamation of George III, issued from the Court of St. James, 7th day of October, 1763, and by the authority of a treaty of peace concluded at Paris on the 10th day of February, the same year, assigned to Colonel Grant—

> The government of East Florida, bounded to the westward by the Gulf of Mexico and the Apalachicola River; to the northward by a line drawn from that part of said river where the Chattahoochee and Flint Rivers meet, to the source of the Saint Mary's River, and by the course of said river to the Atlantic Ocean; and to the eastward and southward by the Atlantic Ocean and the Gulf of Florida, including all islands within six leagues from the sea-coast, with the expectation that rice, indigo, silk, wine, oil, and other valuable commodities would be produced in great abundance.

The English at that time knew little or nothing about coffee, as its cultivation at that period was confined to St. Domingo, and had not been introduced upon the Island of Jamaica. At a later period, an English gentleman of fortune went to establish himself in East Florida, and entered successfully into the culture of coffee and sugar-cane, and his establishments were already considerable when the American Revolution, in its effects, caused Florida to pass into the hands of Spain. The British Government, finding he had so far succeeded, would not allow him to remain, but destroyed his plantation, and carried him off with his slaves, awarding him a considerable sum for his loss and damages.

Mr. Carvert says:

> So mild is the winter that the most delicate vegetables and plants of the Carribee Islands experience there not the least injury from that season; the orange tree, the plantains, the guava, the pineapple, &c., grow luxuriously. Fogs are unknown there, and no country can, therefore, be more salubrious.

Mr. William Stork, in his description of East Florida, gives the following account of it:

> The productions of the northern and southern latitudes grow and blossom by the side of each other, and there is scarcely another climate in the world that can vie with this in displaying such an agreeable and luxuriant mixture of trees, plants, shrubs, and flowers. The red and white pine and the evergreen oak marry their boughs with the chestnut and mahogany trees, the walnut with the cherry, the maple with the campeach, and the braziletto with the sassafras tree, which together cover here a variegated and rich soil. * * * The wax myrtle tree grows everywhere here. * * * Oranges are large, more aromatic and succulent than in Portugal. Plums

naturally grow finer and of a quality superior to those gathered in the orchards in Spain. The wild vines serpentine on the ground, or climb up to the tops of trees. Indigo and cochineal were advantageously cultivated there, and in the year 1777 produced a revenue of $200,000.

Chazotte adds, in 1822:

This country will produce all the tropical fruits and staples by the side of those belonging to a northern climate.

This fact is now being demonstrated in the experience of the recent population of the State.

In impressing upon the attention of Congress the advantages of entering upon the cultivation of coffee and cocoa, or the chocolate plant, in connection with vines, olives, capers, and almonds, Chazotte gives the following statement of feasibility and profits of cultivation:

Coffee.—One acre of land planted by ranges, and the plants at 5 feet distant from each other, gives 1,764 plants. A man can take care of two acres, which gives 3,528 plants. Each plant may, by an average, yield 2 pounds or more, but I reduce it to 1 pound; therefore, a man will give yearly 3,528 pounds of coffee, which, at 25 cents, produces $882.

It is to be observed that no crop is to be expected on the first and second years; on the third year the plant yields a good crop; on the fourth an abundant one, which it will continue to yield every year until the ground is exhausted and the plant dies. For the two first years of the planting, all kinds of vegetables and corn may be planted between the ranges; they will yield two crops in one year. Cotton is not to be planted between the ranges.

Cocoa.—Four acres of land planted in rows, and the trees at 10 feet distant from each other, give 1,764 trees. A man is capable of taking care of them and of gathering the nut. At seven years of age each tree will yield two pounds, and the quantity will increase with its age; therefore, a man will gather 3,528 pounds of cocoa, which, at 15 cents per pound, will produce $529.20.

This cultivation, differing from all others, requires some illustration. It was formerly thought that its culture required much labor and a virgin soil; but experience has shown that it grows on land half exhausted by the coffee-plant, and in less than twelve years' time acquires such power as to destroy the coffee underneath. Hence it is now planted between the ranges of coffee when this last is about seven years of age; so that when the land would otherwise become a mere waste, requiring a hundred years for forests to rise on it again ere it could recover its first fruitfulness, the same land being again covered by a new forest of productive trees, the fruits of which growing and maturing all the year round, each day brings in its crop.

The extraordinary effects of the cocoa tree in regenerating the ground upon which it grows may easily be accounted for. This tree seldom attains higher than fifteen feet; it is branchy, its leaves very large, and the body, or stock, of a middling size; the leaves continually falling off the tree while new ones grow, cover the earth with a thick bed of leaves, which allow not even a blade of grass to grow with them. Hence the ground requires no culture, and the trees but a light pruning when any ravages have been caused by storm. This constant thick bed of leaves returns to the earth five times more nutriment than the diminutive size of the tree requires from it, and in less than thirty years brings the soil back to its original fertile state.

Having given the proceeds of a man's yearly labor in the plantation of coffee and cocoa, I shall now quit Florida and enter the territory of the United States.

Vines.—An acre of land planted with vines, allowing 41 ranges at 5 feet distant, and to each range 104 vines at 2 feet apart, gives 4,264 vines to an acre. Five acres for a man's labor give 21,320 vines; and allowing the grapes of 10 vines to yield 1 gallon of wine, it will produce 2,132 gallons, which, being rated at the low price of 30 cents per gallon, will produce $639.30 for a man's yearly labor. As olives, capers, and almond trees require no particular culture, they may be planted in ranges, at 30 feet distant, in the vineyard, where the mildness of the climate allows the plantation. In Georgia and Alabama these four productions may be raised on the same soil.

Vines, olives, capers, and almonds, planted on the same ground:

5 acres in vines produce, as before stated, for a man's yearly labor	$639 30
175 olive trees, at thirty feet distant, will yield, after seven years of age, about one gallon of oil each, which, valued at the low price of $1.50 per gallon, is	262 50
45 almond trees, 25 caper trees produce, valued at $1.50	105 00
Yearly proceeds of a man's labor	1,006 80

I shall now suppose that, in the course of 30 years, we may employ 50,000 persons in the culture of vines singly:

They will cultivate 250,000 acres of land, which will yield an annual revenue of	$31,965,000
50,000 persons in the culture of vines, olives, almonds, and capers, on 250,000 acres of land, will yield an annual revenue of	50,340,000
Total	82,305,000

Cocoa.—Fifty thousand persons engaged in the culture of cocoa will cultivate 200,000 acres of land, which will yield an annual revenue of $26,420,000.

Coffee.—One hundred thousand persons engaged in the culture of coffee will cultivate 200,000 acres of land, which will yield an annual revenue of $88,200,000.

Recapitulation of the preceding estimates:

100,000 persons cultivating 500,000 acres in vines, olives, &c., produce..	$82,305,000
50,000 persons cultivating 200,000 acres of cocoa	26,420,000
100,000 persons cultivating 200,000 acres of coffee	88,200,000
250,000 persons cultivating 900,000 acres, produce	196,925,000

The home consumption of this country may be estimated to be annually:

Wines, olives, &c	$17,305,000
Cocoa, &c	6,420,000
Coffee	13,200,000
Home consumption	36,925,000

Leaving an immense surplus of exportation to foreign countries of—

Wines, olives, &c	$65,000,000
Cocoa	20,000,000
Coffee	75,000,000
Exportation	160,000,000

FIELD CROPS—SUGAR CANE.

Florida, both in climate and soil, is peculiarly well adapted for growth of cane; the earliest colonists cultivated it, and successive occupants, French, English, Spanish, American, have grown it successfully; the long period of warm weather, and the absence of cold, give a longer period for the cane to mature. During the English occupation many large plantations were opened, and later, since Florida became United

States territory, there have been several large sugar plantations profitably carried on.

Latterly, cane has only been planted for domestic use and neighborhood sale. But, even rudely raised and rudely manufactured, Florida sugar and sirup rival, in color, grain, and quality, the best Louisiana.

Fair land will produce from 1,500 to 2,000 pounds of sugar; rich land, thoroughly fertilized, will produce from 2,000 to 4,000 pounds. Recent improvements in sugar machinery have obviated the necessity of expensive works formerly required, rendering it possible for the small as well as large planter to manufacture cheaply; its cultivation is as easy as corn, and its immunity from all hurt by ordinary enemies to other vegetation renders it a safe crop.

The superiority of Florida over any other section of the United States in adaptability to the growth of cane is mainly based upon her milder climate, the greater length of the seasons, and the correspondingly longer growth and larger size of the cane. In Louisiana from three to five feet may be taken as the average size of cane when harvested, while in Florida from five to seven may be taken as the average size of the cane over the whole State, extending from north to south nearly 400 miles, and, with fair culture, eight, ten, and twelve feet are quite common lengths. As early as 1823, Vignolles wrote:

> Respecting sugar, the recent successful trials that have been made upon it have determined the curious fact that it will grow in almost any of the soils in Florida south of the mouth of the Saint John's River; the great length of summer, or period of absolute elevation of the thermometer above the freezing point, allows the cane to ripen much higher than in Louisiana.

Williams, writing in 1837, says:

> This (sugar) ought to be the staple of the country. Experiments in every part of the territory prove that all our good lands will produce sugar cane as well as any other crop. * * * A general impression has prevailed that sugar could not be made to advantage unless a great capital is invested; but experience abundantly proves that a small capital may be as profitably employed in the culture of cane as in any other product.

In an article on sugar cane in the new American Encyclopedia the climatic disadvantages attending the cultivation of the sugar cane in Louisiana are stated as follows:

> Yet, the climate of Louisiana itself is rather north of that best suited to the plant, the cane being frequently killed by the frost after starting in the spring, and at maturity in the latter part of October and in November, the effect of which is to materially diminish its production of sugar. In 1857, injurious frosts thus occurred in April as late as the 22d, and on the 19th and 20th of November. In November, 1859, the cold was very severe on the 12th, 13th, 14th, and 15th, in all parts of Louisiana, the thermometer on the 14th standing at 25° F. at New Orleans, and thick ice being formed in the most southern parishes. The effect of this was that the cane was everywhere frozen, and land which had previously given above two hogsheads to the acre yielded barely half a hogshead, and this of inferior quality. The climate is also subject to long-continued drought, which seriously injures the growing crops.

But in Florida frosts are of infrequent occurrence, and in South Florida are unknown. Of the few frosts that do occur, instances as early as

November or as late as April have been known only at intervals of years.

With the protection against competition with foreign cheap labor now afforded by the government, sugar will speedily become one of the commanding industries of Southern Florida especially, and a source of immense wealth to the State.

Dr. Westcott, president of the Madison County Agricultural Society, in 1870, gave the following on the subject of cane culture:

> It takes about the same labor to cultivate a sugar-cane crop as it does for corn. For a farmer not cultivating more than 5 or 10 acres of cane, the expense of an iron mill, boilers and brickwork, house or shed, &c., would not cost to exceed $400. To manufacture 10 acres of cane would require the work of six men forty days; one pair of mules, horses, or oxen at the mill, and another pair to haul the cane from the field. The profits of 10 acres planted in cane, from actual experiment, omitting capital required for boilers, mill, troughs for crystallizing, houses for draining, teams, &c., are as follows:

Dr.

Ten days' work of team to break up land, at $1.50 per day	$15 00
24,000 seed cane, at $10 per M	240 00
Fifteen days' work planting, at $1	15 00
Ten days' work with hoe	10 00
Fifteen days' work with cultivators and plows	22 50
Six men 40 days, equal to 240 days' work, manufacturing, at $1	240 00
Two pair oxen 40 days, at $3 per day	120 00
Barrels, &c	60 50
	723 00

Cr.

By 3,700 pounds sugar per acre, 37,000 pounds, at 10 cents	3,700 00
Showing a net profit of	2,977 00

> It is no uncommon thing to produce, by proper fertilizing, 2,000 pounds of sugar and 170 or 200 gallons of sirup, equal to 1,700 pounds of sugar, or a total of 3,700 pounds of sugar, of a superior quality, per acre.

Sugar requires natural strong land, or well-manured light land, the latter making a better quality of sugar. By properly manuring the ratoon, or cane springing up from the root, after the first crop from planting, it will yield nearly the same product for two or three years; after that time experience teaches it is best to remove the roots to other ground. It will be observed that after the first planting there is no more expense for seed cane.

COTTON.

Sea-island or long cotton is raised mostly from the Suwannee River to the ocean, and south of latitude 30°. The average product per acre is from 150 to 200 pounds, though it often exceeds double that. This species of cotton is only raised on the sea islands bordering South Carolina, Georgia, and in Florida, our State raising over half the total crop. The price ranges from 25 to 50 cents per pound, though there are planters who readily get more than these figures, but their cotton is exceptionally fine. Short cotton is grown west of the Suwannee to the western and northern boundaries of the State. It will average from 200 to 500 pounds to the acre. In grade, Florida cotton rates with the best. Cotton raising, however, is subject to some risks; cold, rain, drought, or caterpillar often sweeps localities. Generally speaking, it is a safer crop in Florida than anywhere else. New methods of cultivation, improved seed, remedy for the caterpillar, are adopted by the intelligent and prudent planter, who is not subject to a loss which a careless, shiftless man may have. The methods of cultivation are simple, the crop itself affording by its seed the very best fertilizer. As the seed is fully 75 to 80 per cent. of the cotton as picked, it is largely sold and exported, and its increasing value for manufacture renders the cotton crop profitable, even at the present low price of the staple. At the late cotton exposition in Atlanta, Ga., a bale of long cotton from Florida was pronounced by the foreman of the Willimantic Thread Factory as the best in the entire collection for his purposes, taking the first premium.

RICE.

Rice, which constitutes the main food of the great majority of the population of the world, is raised here mostly for domestic use. There are thousands of acres in every section of the State peculiarly adapted to its successful culture. Its cultivation is as simple as any cereal; usually drilled and kept clear of weeds, 25 to 75 bushels of rough rice is a fair crop. Recent introduction of improved rice machinery, adapted for individual and neighborhood use, will stimulate increased production. Limited by climate, rice will always prove a remunerative crop. It is generally supposed that rice is only successfully grown on low lands which adjoin tide-water, and can be overflowed at certain different stages of growth. It is true that the great bulk of the crop is grown in this way, but more recent experience has demonstrated that it can be grown successfully upon dry land, and upland rice is now becoming one of the reliable and profitable field crops, more remunerative even than wheat at the North. The upland rice from this State displayed at Atlanta received the first premium.

A low, moist soil has generally been planted; overflowing is not needed, but on any good land it is successfully cultivated. It has needed only introduction of rice-cleaning machinery to make its cultivation universal in Florida. Quite recently a company of practical business men have been formed, who have put up extensive works, which will be able to receive and prepare all that may be raised. It may be relied upon as one of the permanent staple products of Florida, which will add largely to the exports of the State and afford a sure and profitable reliance for the farmer.

CORN.

Corn, which is the great food staple raised in the United States, especially in the West, and which exceeds by many millions of bushels any and all other crops, is grown in all portions of the State, and the produce per acre is here, as elsewhere, more or less, according to fertility of soil and cultivation. Ordinary pine land will produce, say, 10 bushels; good hammock land, 20 to 50 bushels, according to the cultivation. Extra culture here, as everywhere, will largely increase the product. Ex-Governor Drew has raised, near his mills at Ellaville, in Madison County, 120 bushels of superior corn to the acre. Corn here is planted in February to April, plowed at intervals, laid by in June and July; blades stripped for fodder, and stalks with ears left in field to be harvested at leisure. It may be cribbed in field in the shuck, suffering no damage from weather, or housed in corn-crib near the dwelling; shucked and shelled if for sale or food. When fed to stock it is fed in shuck. One person with one mule can easily cultivate from thirty to forty acres, and as the time for planting to final plowing is only from four to five months, it leaves ample time to cultivate another crop of pease or sweet potatoes with same labor on same land. The corn usually raised is the white variety, largely used in meal and hominy for food, especially at the South. The Northern farmer who has been used to see 40 to 60 bushels ordinarily raised on the old homestead, should, in comparing the relative production South and North, take into consideration cheapness of land, number of acres which can be cultivated, time taken to make crop, expense of gathering, saving, housing, and also value, transportation, and its quality. White is best for food. All things considered, corn is one of the most useful and profitable crops to raise in Florida.

WHEAT, RYE, OATS.

Wheat in the northern section of the State is grown to some extent, but is not generally raised as a regular crop. Rye and oats do well, and are mostly sown early in the fall, affording a good winter pasturage; mature in early spring, and are not thrashed, being cured and fed to stock in the straw.

PEANUTS.

The peanut, pinder, goober, or ground pea, as the plant is variously called, grows well on almost any warm, light soil. The seed should be planted early in the spring. The after cultivation is simple. A hundred bushels to the acre is an average crop. They are worth $1 to $2 per bushel. The nut produces an oil which is said to be equal to the finest olive oil.

PEAS.

The common English pea is not cultivated as a field crop, but as a garden product is largely grown for the winter market, and affords great profits. The cow pea is extensively grown and produces excellent crops.

It resembles the bean family in the appearance of its foliage and the manner of its growth. It is common to sow them between the rows of corn at the last plowing. They will produce from 10 to 15 bushels per acre, besides a large amount of forage. On account of the luxuriant growth of the vine, on poor soils even, its culture as a green crop, to be turned in, is fully as advantageous as clover at the North.

TOBACCO.

Tobacco will grow anywhere in the State. A superior quality of Cuba tobacco, from imported seed, is mostly grown in Gadsden and adjoining counties, and fully equals the best imported. Before the war it was extensively and profitably cultivated, and mostly sold to Germany, agents visiting the State to purchase. It requires careful attentin, will yield from 500 to 700 pounds to the acre, and sells for from 20 to 30 cents per pound. Latterly there is an increasing home and State demand by cigar manufacturers, and the area of cultivation is extending.

SWEET POTATOES.

This crop, as an article of food, is as universal in all Southern households as rice is to the Chinese, macaroni to the Italian, or the Irish potato to the Irishman. White or black, no family is so poor but what has a potato patch. It yields all the way from 100 to 400 bushels to the acre, according to soil, cultivation and season; is grown from roots, draws, and slips; planted from April to August, and maturing from July to November; is of easy cultivation, and may be dug and safely banked in field and yard, or housed; is eaten raw or cooked, and the old-time cook can make most appetizing dishes of it. There are many varieties planted, good and indifferent, and there is no excuse for not raising the best. It may be raised at a cost of fifteen cents a bushel, and brings in the home market from 40 cents to $1.

IRISH POTATOES.

This crop does not produce as well as at the North, but is off in time to be followed by a crop of sweet potatoes the same year. They should be planted in December or January, although good crops are sometimes obtained from later planting. A covering of muck, grass, or coarse compost is very beneficial. The potatoes are fit for digging in May. They can be shipped without difficulty, and at a moderate expense, to the Northern markets, where they are worth from $5 to $9 per barrel. The culture is essentially the same as that practiced at the North.

ARROWROOT, CASSAVA, COMPTIE.

All these grow well when cultivated, and produce astonishingly. Florida arrowroot grades in quality and price with the best Bermuda. Cassava, from which starch and tapioca are made, attains great size.

Comptie, the bread-root of the Indians, grows without any cultivation. All of the above have only been grown for domestic use for starch and for food, and have limited sale in this and adjoining States. The attention of Northern starch manufacturers has lately been drawn to them, and Governor Sinclair, of New Hampshire, having tested the roots by actual experiments, has introduced a pioneer factory in Orange County. As either and all of these roots have a larger percentage of starch in them than the Irish potato, and can be grown at the same price, and manufactured all the year, we may look for a large business in this industry.

SISAL HEMP, RAMIE, JUTE.

All of the fibrous plants grown in warm latitudes are found here. Some years ago the Sisal hemp was largely grown, but the Indian war broke up the country where it was planted, and the cultivation has not been resumed to any extent. A Key West writer says that a ton of fiber may be grown to an acre, worth $300. Extensive preparations are being made for the cultivation of jute in South Florida, and at no distant day it will become a leading industry. Col. A. B. Lindermann, of Philadelphia, is at the head of a company, recently organized, to test the cultivation of jute and indigo upon a large scale. An ample supply of seed has been imported from India; suitable lands have been selected from the Disston purchase, in Sumter County, and arrangements are now being made to procure the necessary workmen. An expert will visit the crop during the coming summer, and should his report be favorable, a large amount of English capital will at once be invested in the business.

A variety of wild jute is found growing abundantly in East and South Florida. A sample of the fiber of this plant, roughly prepared, was taken to Dundee, Scotland, where the principal jute factories of the world are located, and was valued by the proprietors of the works at $90 per ton. Two crops can be readily grown during the season, and improved machinery has lately been devised for the preparation of the fiber. The plant grows vigorously upon low, wet soils, is difficult to eradicate when once planted, and promises to add another to the many flourishing industries of Florida. It is believed by those who have investigated the subject, that this State is capable of furnishing all the jute required for consumption in this country, now imported from Calcutta at a cost of many millions annually.

INDIGO, CASTOR BEAN, AND SILK.

The indigo plant is indigenous in Florida; during the English occupation it was extensively cultivated, manufactured, and exported; now it is occasionally made for domestic use. The castor bean here attains the size of a tree often 30 feet high, grows rapidly, and bears largely; now only used for home purposes. Silk some years ago attracted a good deal of attention, but is now only occasionally produced as a pastime

The different species of mulberry grow here to perfection from root, cutting, or graft; in leaf from March to October. In time, no doubt, the business will become a regular industry. The company above referred to intends to engage largely in the culture of that valuable dye, indigo. About the year 1770 this article formed the principal export from Florida, and the old works still to be seen in the vicinity of New Smyrna, on Indian River, indicate the vast extent of the plantations devoted to this enterprise.

FRUITS.

The most promising and fascinating industry, now absorbing attention, more particularly in East and South Florida, is the cultivation of fruits, of which the citrus family takes the first rank. This group comprises all the varieties of the orange, citron, lemon, lime, and shaddock, numbering more than a hundred.

Dr. Sickler, who spent six years in Italy, and paid great attention to the kinds and culture of the citrus, published at Weimar, in 1815, a quarto volume, called Volkommene Orangerie Gartner, in which he describes seventy-four sorts. He arranges the whole into two classes, and these classes into divisions and subdivisions, without regard to their botanical distinctions or species, as follows:

	Sorts.
Lemons:	
Cedrats, or citrons	4
Round lemons	6
Pear-shaped lemons	11
Cylindrical lemons	4
Gourd-shaped lemons	2
Wax lemons	5
Lumies lemons	8
Cedrat, lemons or citronate	6
Limes	4
Oranges:	
Bitter oranges	6
Sour oranges	6
Sweet oranges	12

Few other classes of fruits are more easily propagated than the citrus, and all of the species may be rapidly increased and produced either by seeds, cuttings, layers, grafting, or budding, the lime being the most difficult and the citron the most easy of propagation. They differ from deciduous fruits in the respect that like always produces like, the seed of every variety invariably producing its kind. Cuttings of thrifty wood, two years old, strike fibers as rapidly as younger wood, though the mode of propagating almost universally adopted in Florida is by budding upon young stocks from the nursery, or from the larger stocks obtained from the forests. The citrus family of fruits is supposed to have originated in the warmer parts of Asia, and to have derived its name from the town of Citron, in Judea, though it has been cultivated from time immemorial in middle and southern Europe, and is now cultivated almost throughout the world, and in no higher degree of perfection tha in East Florida, south of the 30th degree of north latitude.

THE ORANGE.

The cultivation of the orange (*Citrus aurantium*) in East Florida, pre vious to 1835, had attained a degree of considerable commercial impo tance, and the exports of this fruit from the small city of Saint Augustin are said to have amounted to $100,000 annually. On the Saint John's River, and in some parts of West Florida, and at Tampa Bay, grove were being established as a source of commercial supply. In February 1835, a very severe frost visited the State, and most of the orange grove and other semi-tropical fruits were destroyed, or nearly so, leaving onl the stumps and roots to spring up again. Many of these sent up shoots and began to encourage hopes of returning prosperity to this branch o industry. These hopes were not permitted to be realized, however, for i 1842 an insect called the *Orange coccus*, or scale insect, appeared in th orange groves, and spread with great rapidity over the whole countr almost totally destroying every tree attacked.

This calamity continued for ten or twelve years, and bade defiance t almost every effort made to stay its blighting force. Many becam discouraged in the contest and abandoned further attempts to re-estab lish this heretofore agreeable and profitable branch of industry. I 1853, however, the insect began to decrease in numbers, and finally dis appeared, since which time most of the groves now in the State mus date their birth. These groves are rapidly multiplying in all parts o the State, and the bearing trees are now numbered by tens of thousand while the young groves, which are being constantly started, compris millions of trees. The orange from the seed produces fruit in fro seven to ten years, depending upon situation, culture, &c.

Groves made from wild stocks, usually cut off at a height of 3 to feet from the ground, and the new shoots budded, generally produc fruit in three years. The number of oranges produced from a singl tree varies from 100 to 10,000, according to the age, situation, and treat ment of the tree. The trees are usually set 20 feet apart, and an acr will contain about 100 trees. Florida oranges were usually sold, previ ous to 1835, at $7.50 to $10 per thousand. Now a demand exists fo twenty times our present supply, at $15 to $20 per thousand, as the hang upon the trees.

HOW TO MAKE AN ORANGE GROVE.

The judicious selection of the land is the first and most importa point, for on this success in a great measure depends. Choose high dry hammock or high rolling pine land that has natural drainage and yellowish subsoil. The low, flat lands which are underlaid with hard pan or sandstone, mixed with oxide of iron, require ditching or drai ing and much care in setting the trees, so that the roots may have free scope and relief from standing water. The most favorable locations are on southeast side of wide sheets of water, or high lands, which are more generally free from frost. The land selected, clear thoroughly of all trees, &c., break up well, and substantially fence; sow with cow peas, which turn under when in bloom—it improves and sweetens the soil; this may be done before or after planting trees. Dig holes 30 feet apart, 18 inches deep, and 4 feet in diameter; clean out all roots; fill up with top soil, which will retain the moisture; procure trees from three to five years old, take them up carefully, with all of the roots possible, pack up with wet moss as soon as dug, put in shade and out of the wind, take to the proposed grove carefully; remove soil from holes dug sufficient for the tree, with roots carefully spread, trunk standing in same position as originally grown. Let the tree, when set out, be fully an inch above natural level of land; fill under, in and about the roots, compactly—it is best done by the hand, filled to surface and gently tramped down; fill on some 2 or 3 inches of earth, which will prevent drying; the rainy season commencing, remove the soil about the tree to the level about it. Cultivation should be frequent and shallow, and trash not allowed to accumulate near trunk; light plowing and raking near the trees is best and safest. Following these general directions, no one should fail. The cost of a five-acre grove, at, say, five years from planting, at a liberal estimate where high pine land is chosen, will be about as given below. If hammock land is taken, the cost of clearing will be more. The grove will have begun to yield at the end of the period named. Rev. T. E. Moore, Fruit Cove, Fla., has published a good treatise on orange culture.

COST OF GROVE.

Five acres of good land, variously estimated, depending on location.	
Cutting timber, clearing	$75 00
Fencing (post and board fence) and breaking up	75 00
Three hundred trees and setting out	200 00
Manures, labor, cultivating, taxes, &c., for five years	500 00
Total, less cost of land	850 00

Such a grove would readily sell now in Florida for $1,000 per acre. From and after five years the annual growth of trees and increase of fruit is constant for at least ten years, and the grove will hold its vigor and fruit-producing qualities for a century or more. The orange is a hardy tree, will stand great extremes of rain and drought; it will show the effects of a single season's neglect, and quickly show a single season of care and attention.

THE LEMON.

The lemon is produced in East Florida to a degree of perfection far surpassing the same fruit grown in the West Indies, Sicily, Italy, or

Spain, and persons familiar with this fruit in those countries are rather disposed to discredit the statement that the lemons of Florida are of the same variety of fruit. The Sicily lemon grown here frequently reaches from 1 to 2 pounds in weight, and is of a superior quality.

VARIOUS FRUITS.

There are five of the acid varieties of the lime (*Citrus limetta*) named in English nursery catalogues. The juice of the lime is preferred to that of the lemon as being more wholesome and agreeable, and when freely used is a preventive of fever. Combined with a little salt, it is regarded by some of the old settlers as a specific for chills and fever.

The citron (*Citrus medica*) is commercially known in the United States as a preserved confection, imported from the Mediterranean in oblong boxes, weighing 20 to 25 pounds each, and used by families as an addition to fruit cakes, pies, &c. It is a native of the warm regions of Asia. Heretofore but little attention has been paid to the cultivation of this fruit in Florida, except for variety and ornaments, and it is not usual to observe more than one or two trees in a large garden of several acres in extent, though it is grown here with the greatest ease and perfection, frequently producing fruit weighing 10 pounds, and there is no doubt but that it may be cultivated, preserved, and introduced into our home markets as an article of commerce with great profit to the producer. There is no other variety of this species so easily propagated, and none more hardy, or that yields its fruit so quickly, or produces more abundantly; and the fact that both the fruit and the sugar for preserving it are produced in the same field, with equal facility, gives to the American cultivator a great advantage over the foreign producer in our markets. The citron prepared and preserved by private families in Florida for home use is of much finer quality, lighter colored, and more transparent than the imported. The cost of preparing this fruit for market on a large scale need not be great, and the combination of two articles, green citron and sugar, the cost of producing which does not exceed one-half their actual value, where the two are combined, must leave a large margin of profit to those who engage intelligently and with proper facilities in the business of cultivating and preparing this article for market.

The shaddock (*Citrus decumana*), a native of India or China, is now cultivated in all warm climates, and is called *Arancio massino* by the Italians, *Oranger pampelmouse* by the French, and sometimes in this country mock-orange or forbidden fruit. It was brought from China to the West Indies by Captain Shaddock, from whom it derives its present name. There are at least six varieties, only one of which is useful or desirable as a fruit. Some of these attain a very large size, frequently weighing 10 to 14 pounds. It is chiefly used for ornament or show, and where several sorts of oranges are presented at desert, it forms a striking addition to the varieties in the way of contrast. The most desirable variety of this fruit is sometimes called grape fruit. It possesses a red dish pulp, with most agreeable subacid sweetness, and is excellent for quenching thirst; and from the thickness of its rind will keep longer than the fruit of any other of the citrus family. This variety is well worth cultivating for the excellence of its solid vinous pulp, which furnishes a substitute for other acid fruits in pies, tarts, jellies, &c.

Loquat (*Eriobotrya japonica*) is known in the South as the Japan plum. The tree is an evergreen, and grows 10 to 12 feet high, and is desirable in every Southern garden on account of its hardiness, withstanding a greater degree of cold than any of the semi-tropical fruits. It ripens its fruit in February and March, when most other fruits are gone; is a profuse bearer, and is readily propagated by seeds and cuttings.

The pine apple (*Ananassa sativa*) is grown in some of the gardens in the northern portions of the State, but requires protection. South of parallel 28° it is produced in greal excellence and perfection, the pines frequently weighing 9 and 10 pounds each. This fruit is easily propagated from suckers and crowns, the former preferable, however, the fruit maturing in three to four months after planting the suckers.

Papaw (*Carica papaya*) is sometimes called the bread-fruit tree. It is a native of South Ameria. This remarkable tree, though not much cultivated at the present time in Florida, is worthy of great attention, not only for the excellence of its fruit, but also for its other extraordinary properties. The tree attains a growth of 20 feet in height, and yields a large supply of fruit in three years from the seed, and should be in every garden in Florida south of 30° north latitude. It thrives well and bears profusely at Saint Augustine. The fruit is pear shaped, of a light yellow color, varying in size from 3 to 5 inches in length and from 2 to 4 inches in diameter, and is not unlike a very ripe muskmelon in taste and flavor, though sweeter. It may be pared and sliced and eaten raw as a desert fruit, or cut into slices and soaked in water till the milky juice is out, and then boiled and served as a sauce, or by the addition of lemon or lime juice, it supplies a most excellent substitute for apple sauce or tart fruit, to which it is scarcely inferior. The juice of the pulp also forms an excellent cosmetic for removing freckles from the skin, and the leaves are frequently used, in the French West India Islands, instead of soap for cleansing linen. Its remarkable medical properties, however, are most important, as it is the most powerful vermifuge known, a single dose of the milky juice of the unripe fruit, or of the powdered seeds of the ripe fruit being sufficient to cure the worst cases, and extirpate every worm from the system of the patient.

The most extraordinary property of the papaw tree is that related by Dr. Browne, in his Natural History of Jamaica, in which he says that the toughest meat or poultry may be made perfectly tender for cooking, by steeping for eight or ten minutes in the milky juice of this tree. Dr. Holden, who witnessed its effects in the island of Barbadoes, says, in the third volume of the Wernerian Society's Memoirs, that the juice of this tree causes a separation of the muscular fiber in meats that have been immersed therein and that the vapor of the tree serves the same purpose, it being a common custom with the inhabitants to suspend joints of meat, poultry, &c., in the upper branches of the trees to soften and prepare them for cooking.

Thompson, in his System of Chemistry, makes an extract from a French work on chemistry, entitled *Annales de Chimie*, which states that—

> Fibrine had been previously supposed to belong exclusively to the animal kingdom but this tree had been found to contain this substance.

The papaw tree is a perpetual bearer of fruits and flowers, or blossoms, and yields enormous quantities of fruit, a single tree supplying enough for a large family.

Custard apple (*Anona reticulata*) is sometimes called sugar apple. There are upwards of forty varieties of this fruit, and nearly all the species are edible. Almost every tropical country lays claim to its own favorite variety. In Peru it is greatly esteemed, and considered not inferior to any other fruit in the world. The species derives its English name (custard apple) from the consistence of the pulp of the fruit; and its rich color, fragrant odor, and handsome appearance are well characterized in the expression, "apples of gold in pictures of silver."

The Spanish-American cherimoyer (*Anona cherimolia*), and the West India soursop (*Anona muricata*), sweetsop (*Anona squamosa*), and alligator apple (*Anona palustris*) are of this genus. This delicious fruit is produced in excellent perfection as far north as Saint Augustine, and is easily propagated from seed.

FIGS.

Figs are easily raised from cuttings, and begin to bear in two years, producing one good and one or two additional but inferior crops annually. Two hundred trees may be set at nominal cost on an acre. The remarkable vigor and thrift attending the growth of the fig in this State, and the many facilities afforded for an unlimited business growing out of its cultivation and preparation for market, are so decided, that this fruit is worthy, like the orange and cane, of special attention here. A simple preparation of figs by boiling in sirup will furnish a most palatable and wholesome preserve, that only needs to be known to become a universal favorite; and if figs can be prepared for a lucrative market, by drying, anywhere on earth, it can be done in Florida. The London Encyclopedia mentions fifty-six species, of which the following are the most remarkable:

F. carica, the common fig tree with an upright stem branching fifteen or twenty feet high, and garnished with large palinated or hand-shaped leaves. Of this there are many varieties, as the common fig tree, with large, oblong, dark purplish blue fruit, which ripens in August either on standards or walls, and of which it carries a great quantity; the brown or chestnut fig, a large, globular, chestnut-colored fruit having a purplish delicious pulp; the black Ischia fig, a middle-sized, shortish, flat-crowned, blackish fruit, having a bright pulp; the green Ischia fig, a large, oblong, globular-headed, greenish fruit, slightly stained by the pulp to a reddish-brown color; the brown Ischia fig, a small, pyramidal, brownish-yellow fruit, having a purplish rich pulp; the Malta fig, a small, flat-topped, brown fruit; the round brown Naples fig, a globular, middle-sized, light-brown fruit, and brownish pulp; the long, brown Naples fig, a long, dark-brown fruit, having a reddish pulp; the great blue fig, a large blue fruit, having a fine red pulp; the black Genoa fig, a large pear-shaped, black-colored fruit, with a bright-red pulp. It may be propagated either by suckers arising from roots, by layers, or by cuttings. The suckers are to be taken off as low down as possible; trim off any ragged part at bottom, leaving the top entire, especially if for standards, and plant them in nursery lines at two or three feet distance, or they may at once be planted where they are to remain.

The best season for propagating these trees by layers is in autumn; but it may be also done any time from October to March or April. Choose the young pliable lower shoots from the fruitful branches; lay them in the usual way, covering the body of the layers 3 or 4 inches deep in the ground, keeping the top entire, and as upright as possible; and they will be rooted and fit to separate from the parent in autumn, when they may be planted either in the nursery or where they are to remain. The time for propagating by cuttings is either at the fall of the leaf or in February. Choose well-ripened shoots of the preceding summer, short and of robust growth, from about twelve to fifteen inches long, having an inch or two of the two years' wood at their base, the tips left entire; plant them six or eight inches deep, in a bed or border of good earth, in rows two feet asunder.

GUAIAVA.

The name guaiava (*Psidium guaiava*) is a corruption of the Spanish word *guayaba*. Of this fruit there are seventeen different species. It is an evergreen tree or shrub, and indigenous to Brazil, Spanish America, and the West Indies. It is propagated by cuttings and seed, and is sometimes liable to injury from severe frosts north of 28° north latitude, but south of that line it is ever-bearing, yielding its delicious, aromatic, and wholesome fruit all the year round. Only three or four varieties are known and cultivated in Florida.

In the island of Cuba and in Brazil the varieties produced are more numerous, and large quantities of the fruit are made into jellies for exportation to all parts of the world. The fruit of the common guaiava is pear-shaped, of the size of a large hen's egg, and sometimes larger, and has a smooth, pale-yellow skin, inclosing a many-seeded pulp of delicious acidity. In some varieties the pulp is of a light-cream, and others a pale-reddish color. This fruit is greatly esteemed wherever known, and, being slightly astringent, as well as mucilaginous, is very beneficial in bowel complaints. The roots and leaves are also astringent, and are regarded as excellent for strengthening the stomach and bowels. The plant is propagated by seeds, cuttings, and suckers.

POMEGRANATE.

The pomegranate (*Punica granatum*), a shrub or bush-like tree, is a native of Persia and Syria, and grows wild in those countries. It is perfectly hardy in all parts of Florida, and as far north as Hilton Head, S. C., and is widely cultivated and much esteemed in this State for the excellence of its fruit, as well as for the medicinal properties of the rind and the flowers, which are not only an excellent febrifuge, but powerful astringents, and often used with great benefit in cases of diarrhea. The pulp of the fruit is a delicious sub-acid substance, similar in taste and flavor to the red currant, and is excellent for allaying heat and quenching thirst, and is gently laxative. The fruit of the pomegranate is spherical, the size of an orange, with a gourd-like shell or rind, which is filled with seeds inclosed in membranous cells, and surrounded with a juicy, reddish pulp. There are several varieties of this fruit, comprising early, medium, and late. The early and the medium varieties have a pale yellow skin or rind, with a beautiful tinge of red upon the side or cheek, and are sparsely dotted with fine pippin-like spots. The latter sorts have a dark russet-colored rind, and the seeds are of a pale pink color. This tree bears a beautiful urn-shaped scarlet flower; and there is no tree more showy than the pomegranate when in flower. The fruit begins to ripen at Saint Augustine, Fla., about the middle of July, and continues until the middle of December. It bears transportation well on account of its hard rind, keeps for several weeks after it has been taken from the tree, and no doubt may be made a profitable market fruit. It is increased by cuttings, layers, and suckers, and thrifty wood two years old strikes fibers as readily as younger wood.

BANANA.

Banana (*Musa paradisiaca*).—Of the banana and plantain (*Musa sapientum*) there are several species. They are increased by suckers, and require a rich, moist soil, with warm exposure. Some varieties of these plants are successfully cultivated as far north as 30° north latitude. The best variety for cultivation north of 28° north latitude is the one known as *Musa paradisiaca cavendishii*. This is the most hardy, and seldom attains a height above 8 feet, while the more tender kinds often grow 20 feet high. When the plant is fruiting, and all the flowers are set, it is advisable to cut off the spadix an inch or two above the last tier of perfectly-formed fruit, in order to hasten and perfect the remaining fruit.

There are few more excellent or delicious dessert fruits than the banana, and as a food plant its importance and value, as compared with other food plants, can hardly be overestimated. In an economical point of view it has never been appreciated in Florida, where but little attention has been given to its cultivation. When it is realized that a plantation of bananas once established has never to be renewed, and that one acre of this fruit will produce as much food as 130 acres of wheat, or 45 acres of potatoes, its value and importance will be readily acknowledged. As this plant is a great feeder, and when once planted lasts for a lifetime, it is of the utmost importance that plantings should be made upon strong rich soil, or that the plants be kept highly manured, to secure permanent supplies of the best fruit. In Brazil and other tropical countries plantations are formed by setting the plants 20 feet apart; but as the kinds usually planted in those countries are of a larger species than those recommended for Northern Florida, plants of the *Musa paradisiaca cavendishii* variety should be set 10 feet apart each way, and in a good soil they will soon cover the ground, as they increase rapidly under favorable circumstances. Each plant produces one, and only one, bunch of bananas, when it is cut down with a sharp spade or ax to give place to succeeding plants.

When the enormous yield of this fruit is considered, and the fact taken into account that when once properly planted it needs no other attention than simply gathering the fruit, the demand for which is almost unlimited, it is evident that its cultivation could be made very profitable.

DATE PALM.

The date palm (*Phœnix dactylifera*) is an excellent and valuable fruit, and is cultivated with entire success south of 28° north latitude, and the tree often perfects its fruit as far north as 30° north latitude. Numerous large and beautiful specimens of this tree may be seen in the gardens at Saint Augustine. It is one of the most beautiful trees of the vegetable kingdom. Its long, graceful, ever-verdant, ever-waving, ever-changing branches make it the most picturesque of all others for landscape gardening, and should adorn the grounds of every homestead in Florida.

The fruit is greatly and justly esteemed by the inhabitants of Egypt, Arabia, and Persia on account of its concentrated and nutritious properties; large numbers subsist almost entirely upon it. It is generally the sole food of the Arabs and their camels in their long and tedious journeys over the desert, the voyagers feeding upon the fruit and the animals upon the stones. The inhabitants of these countries also boast of the medicinal qualities of the date fruit, and of the numerous uses to which the different productions of this tree may be applied. From the leaves they make couches, baskets, bags, mats, and brushes; from the branches or stalks, cages for their poultry and fences for their gardens; from the fibers of the trunk, thread, ropes, and rigging; from the sap, a spirituous liquor, and the body of the tree furnishes fuel. The date palm is propagated from the seeds and suckers, but more successfully from the former. The cultivation of this fruit should be greatly extended, as it may become an important and profitable resource of the inhabitants of Southern Florida. The bunches or clusters of this fruit often attain a weight of 15 pounds.

PERSIMMON.

The persimmon is found wild in every section of the State. The fruit, at least to the natives, is agreeable to the taste, and, ripe or dry, is used largely for the table and for home-made beer. Some Japan varieties are now being introduced, which are said to be of very large size, and seedless. The Japanese esteem the persimmon as their most valuable fruit.

GRAPES.

The grape is found wild in the forests of Florida, and grows luxuriantly. The foreign varieties grow and fruit well, but are afflicted with the *Phylloxera*, and their successful cultivation is not permanently reliable. The Saint Augustine grape, so called, is a choice grape for the table, or for wines. It grows luxuriantly; but is subject to rot during the rainy season. It resembles the grape from which the Madeira wines are made. The Scuppernong, in all its varieties, is the most reliable, as it is a rank grower, prolific in fruit, and free from disease. It makes a wine equal to the best California, and can be grown to great profit. Forty-five feet square are allowed to each vine, and it soon occupies this space, yielding many bushels to each plant. It is a late grape, and a good table fruit. An acre yields upwards of 2,000 gallons of wine.

PEACHES.

The peach is a sure tree here, bearing in two years from the seed, and early varieties of good size and flavor ripening in May, June, and July. The apricot and nectarine are also safe to cultivate. As yet, no disease has affected the trees, and they retain their vigor and prolific bearing for many years.

The northern grown trees do not do well, as they do not seem able to adapt themselves to the climate, but seedlings succeed, make a rapid growth, and are true to the variety planted. Some very fine varieties have been produced, and when this fruit shall receive the attention due to its value and importance, it will be found a valuable product for export to northern markets, where it can be placed in advance of the products there, and command good prices.

PEARS.

The northern varieties of the pear do well here, though they grow and bear fruit at uncertain periods. But the Le Conte pear, as it is called, is a southern variety, equal to the Bartlett, free from disease, and prolific to a high degree. It is rapidly gaining favor, and its cultivation is being extended. It brings from $6 to $10 per bushel in the northern market, where it is placed in advance of the more northern varieties. [illegible] yields an enormous profit, greater than the orange in many localities.

APPLES.

The cultivation of the apple here is of doubtful utility, though it is believed that some of the earlier varieties may be advantageously introduced.

NECTARINE, APRICOT, AND PLUM.

The nectarine (*Amygdalus persica*), the apricot (*Prunus armeniaca*), and the almond (*Amygdalus communis*) are all at home in Florida, and not less vigorous and healthy, but not reliable for fruiting in all portions of the State, whether from defective culture or adaptability to the variety of soils is not yet determined, as very little attention has been given to them.

The plum and prune (*Prunus domestica*) are also healthy and productive, but not exempt from the ravages of the curculio, so prevalent at the north. All the varieties of the wild plum are indigenous and abundant in every part of the State. Many of the varieties are of excellent quality, and, when cooked, form a delicious preserve for family use, or for canning.

OLIVE.

With the exception of a few trees grown for ornament, this most valuable tree, the olive, has not been cultivated in this State. That it will succeed well here is evident from the specimens now growing. Recently, attention has been directed to its cultivation, and it will become widely planted. It commences to bear at about ten years from the seed, increasing yearly to the age of thirty years, bearing annually. They are very long-lived; some trees in Europe are known to be eight hundred years old, and show no signs of decay. The fruit and oil are valuable as food and of commercial importance.

NUTS.

The pecan nut and the Madeira nut succeed well, and produce abundantly in the northern portion of the State.

The cocoa-nut and the Brazil nut are produced in the southern portion, and the former is receiving special attention in Monroe County, where thousands are being planted in the vicinity of Key West. Large groves are also being set out on Lake Worth.

TEA.

The tea plant has long been successfully cultivated in Georgia, and through the instrumentality of the Department of Agriculture, at Washington, it has been largely diffused through this State; and while it may not, in the face of competition with foreign labor, immediately become remunerative, yet it will be produced to some extent for home consumption, and in time may become a profitable product.

COFFEE.

The coffee plant has been successfully introduced from South America, and its production in South Florida gives the assurance that it may be grown in that portion of the State at least, if not further north, and that in time it may become an important factor in the varied industries and products of the South. The first pound of coffee ever produced in the United States by open-air culture was grown in Manatee, and received the premium offered by the Department of Agriculture.

STRAWBERRIES.

This queen of small fruits nowhere in the world finds a better location for culture; plants put out in September fruit often in January, frequently in February, and may be counted in full bearing and ripening in March and April. The growers about Jacksonville and up the Saint John's River are many, and shipments have been made largely and profitably. In size, color, bouquet, and taste, they are superior to most, equal to the best, and surpassed by none; the best varieties only are grown. The cultivators pick carefully, select and pack honestly; and Florida strawberries, like Florida oranges, have earned a name. By using refrigerators the fruit reaches New York and the Northern cities, fresh and cool, only about four days from picking. Being always in advance of any other locality by some weeks, the first shipments bring large prices, and the demand keeps pace with the supply.

BLACKBERRIES, HUCKLEBERRIES.

The low-creeping blackberry, or dewberry, abounds in old fields and road-sides, and ripens in April. The high bush, also found in same localities, ripens in June and July; the huckleberry about the same time. All bear well, and can be had for picking. The improved kinds do well where tried.

MELONS.

Watermelons, muskmelons, and cantaleups are readily produced everywhere in the State, and the first are grown extensively for export to the Northern cities. One thousand melons to the acre is considered a fair crop, and the standard size for export is 20 pounds and upwards. They are grown to the size of 60 pounds or more, and no better fruit is produced anywhere.

VEGETABLES.

Along the navigable streams and the lines of railway, the raising of vegetables for export has become an important element in the prosperity of Florida, and is rapidly assuming proportions which claim attention from the transportation lines and the cities of the North. Tomatoes, cucumbers, cabbages, celery, lettuce, beets, turnips, onions, Irish potatoes, snap-beans, Lima beans, pease, egg-plants, okra, and all the variety of vegetables are produced most successfully during the winter and spring months, and as improved methods and better culture are introduced, the results prove that every month in the year may yield handsome returns to the cultivator of the soil, and demonstrate that the cheap lands of Florida may afford greater returns in value for the same labor than the best lands of the North and West.

WORK OF THE SEASONS.

The farm and garden work for the year is briefly indicated, as follows:

In *January* plant Irish potatoes, pease, beets, turnips, cabbage, and all hardy or semi-hardy vegetables; make hot-beds for pushing the more tender plants, such as melons, tomatoes, okra, egg-plants, &c.; set out fruit and other trees and shrubbery.

February.—Keep planting for a succession, same as in January; in addition, plant vines of all kinds, shrubbery, and fruit trees of all kinds, especially of the citrus family, snap-beans, corn; bed sweet potatoes for draws and slips. Oats may also be still sown, as they are in previous months.

March.—Corn, oats, and planting of February may be continued; transplant tomatoes, egg-plants, melons, beans, and vines of all kinds; mulberries and blackberries are now ripening.

April.—Plant as in March, except Irish potatoes, kohl rabi, turnips; continue to transplant tomatoes, okra, egg-plants; sow millet, corn, cow peas, for fodder; plant the butter-bean, lady pease; dig Irish potatoes. Onions, beets, and usual early vegetables should be plenty for table.

May.—Plant sweet potatoes for draws in beds; continue planting corn for table; snap-beans, pease, and cucumbers ought to be well forward for use; continue planting okra, egg-plants, pepper, and butter beans.

June.—The heavy planting of sweet potatoes and cow peas is now in order; Irish potatoes, tomatoes, and a great variety of table vegetables are now ready, as also plums, early peaches, and grapes.

July.—Sweet potatoes and cow peas are safe to plant, the rainy season being favorable; grapes, peaches, and figs are in full season. Orange trees may be set out if the season is wet.

August.—Finish up planting sweet potatoes and cow peas; sow cabbage, cauliflower, turnips for fall planting; plant kohl rabi and rutabagas; transplant orange trees and bud; last of month plant a few Irish potatoes and beans.

September.—Now is the time to commence for the true winter garden, the garden which is commenced in the North in April and May. Plant the whole range of vegetables except sweet potatoes; set out asparagus, onion sets, and strawberry plants.

October.—Plant same as last month; put in garden peas; set out cabbage plants; dig sweet potatoes; sow oats, rye, &c.

November.—A good month for garden; continue to plant and transplant, same as for October; sow oats, barley, and rye for winter pasturage or crops; dig sweet potatoes; house or bank them; make sugar and sirup.

December.—Clear up generally; fence, ditch, manure, and sow and plant hardy vegetables; plant, set out orange trees, fruit trees, and shrubbery; keep a sharp lookout for an occasional frost; a slight protection will prevent injury.

TIMBER AND LUMBER.

Of the States, Florida has the largest area of original growth of timber. Excluding land in cultivation, the area covered by lakes, rivers, savannas, &c., there are probably nearly, if not quite, 30,000,000 acres of land covered with timber, and of this the yellow pine is fully three-quarters. The level lands, rolling lands, are mostly covered with the yellow and pitch pine, which attains a great size in girth and length. The lower lands, near rivers, lakes, swamps, abound in valuable timber, of which live oak, other species of oak, hickory, ash, beech, cedar, magnolia, sweet bay, gum, cypress, constitute a great proportion. The red cedar is particularly adapted for lead pencils, and largely exported to Europe for the best manufacturers, as also North and East. The magnolia and bay are fine woods for onamental furniture; the cypress valuable for shingles, sash, doors, blinds and inside finish, railroad ties. The yellow and pitch pine has a world-wide reputation as being the best for any and all uses where strength, elasticity, and durability are desired, and is now being largely used in ornamental and expensive structures. Finished up in its natural grain for inside work, floors, frames, pillars, arches, roofs, it presents that substantial as well as rich finish not attained with other material. An extensive business has long been prosecuted in the western portion of the State in the exportation of pine timber and lumber, and live oak and cedar have been supplied in large quantities for naval architecture and the manufacture of pencils. Large establishments for the manufacture of lumber for exportation to northern and foreign ports are located on the navigable streams and railroads. Naval stores are also largely exported, and afford a reliable source of revenue to the State and the manufacturers.

THE FORESTS OF FLORIDA.

From a gentleman who has been connected with the Tenth Census of the United States the following information has been obtained relative to the forest growth of this State:

> The variety of trees in Florida is greater than in any other of the States, there being nearly, or quite, two hundred arborescent species, or half of all in the United States.
>
> One of these, the yellow pine, is a hundredfold more abundant and more valnable than all the others combined. This is the most valuable of American trees for framing-timber, flooring, &c., and the present reserve of it is almost wholly confined to South Georgia and the northern half of Florida. This is the tree from which turpentine and rosin are obtained. There is very little yellow pine suitable for shipping south of latitude 29°, but plenty for home consumption as far south as latitude 27°.

South of latitude 27°, to the southern limit of the State, there is plenty of the Southern pitch pine, which is equally good for turpentine, and furnishes very good building material. There is also a belt of it, perhaps ten miles in width, bordering the entire coast. There are five other kinds of pine in the State, of less value and in small quantity.

Next to the yellow pine in abundance and value rank the bald cypress and live oak. Both are found throughout the State in abundance and of large size. The qualities of live oak are well known, better than those of the cypress, a timber only second in value to yellow pine, and for durability and lightness superior to it. Several mills are now sawing cypress, and the manufacture of it must increase.

The red cedar of Florida is celebrated as being the only wood suitable for pencils. The demand for it is so great that the supply will probably be exhausted before many years.

Throughout the pine woods, north of latitude 27°, are scattered much post and black-jack oak, which furnish superior fuel. The other kinds of trees occur in groves or hammocks and border water-courses.

Along the southern half of the Saint John's and Indian Rivers the palmetto is the most abundant tree, but, as a rule, the hammocks are composed in most part of the live oak and the water or willow oak, with much red bay, magnolia, and hickory. Besides these, there is a great variety of smaller trees, with handsome evergreen foliage and wood suitable for various purposes. In some hammocks the sour and bitter-sweet oranges abound.

The trees most noted for beauty of wood are the "curly" variety of the yellow pine, the red or sweet bay (sometimes called Florida mahogany), the magnolia, black cherry, holly, &c.

In Jackson and Gadsden Counties are found the black walnut, sour wood, bass wood, beech, birch, sugar maple, cottonwood, sycamore, and many other Northern trees. This section is not suited to the growth of the orange.

Trees common in low hammocks and swamps are the white bay, tan bay, elm, ash, hickory, red maple, sweet gum, sour gum, poplar, hackberry, iron-wood, &c.

The number of species of the most important genera are as follows: Oak, 13; pine 7; hickory, 5; elm, ash, maple, magnolia, and gum, 3 each.

South of the Caloosahatchie River, and on the east and west coasts, as far north as Mosquito Inlet and Cedar Keys, the trees are nearly all of subtropical species, among which are some of great beauty and value, such as the mahogany, lignum vitæ, prince-wood, mastic, wild tamarind, calabash, royal palm, Indian fig, crab-wood, &c. But these are found in too limited quantity to be of any practical importance.

In addition to these are the Madeira, frankincense, white-wood, cork-wood, sea grape, green ebony, wild cherry, buttonwood, black and rock mangrove, and numerous others.

A variety of the caoutchouc grows in South Florida, which furnishes a gum possessing the qualities of the India rubber of commerce.

It is believed that the cinchona, which furnishes that valuable article quinine, could be successfully cultivated. Other trees and plants of great merit and utility can doubtless also be introduced.

An experimental garden, under the auspices of the Department of Agriculture, would be attended with signal benefit to the interests of the country.

LAKE OKEECHOBEE AND THE EVERGLADES.

But little is known of the vast region covered by Lake Okeechobee and the everglades. Much of that immense area is unexplored and unsurveyed, and few, besides the wandering cowboys, ever traverse its wild solitudes. Its almost absolute inaccessibility has practically shut it out from settlement; and for years it has been occupied by the small remnant of the Indian tribes that once owned the country, and by vast herds of cattle, which thrive and fatten upon the rich pasturage.

Very recently the eyes of capitalists have been directed to this remote wilderness, and science has demonstrated that this section can be reclaimed and subjected to cultivation. A careful analysis of the soil reveals the fact that it contains a remarkable percentage of the elements necessary to sustain vegetation, and that the most exhausting crops can be produced for years without any diminution of its natural fertility. These lands, when drained and properly handled, will be found capable of supplying a very large portion of the sugar now consumed in the United States. They are admirably adapted to the production of this important staple, and are fully equal, if not superior, to the most valuable lands devoted to this crop in Cuba and Louisiana. Here the cane reaches maturity, and regularly goes to tassel, showing that the stalk has reached its highest point of development, and that its juices contain the largest amount possible of saccharine matter. One planting of the seed suffices for several years, the plant *rattooning* for a number of seasons from the old stubble. Another advantage of the utmost consequence is found in the fact that, situated as this region is, below the frost line, the cane can be cut and ground to suit the convenience of the planter.

Mr. H. A. Hough, who resides on Twelve-Mile Branch, an arm of the Caloosahatchee River, had his sugar-mill destroyed by fire in January, 1881, before his cane had been harvested. The building was re-erected in the following April, when the cane was cut and ground, making a full average yield of superior sugar and sirup, for which the highest prices were obtained. It is customary in that section to replant cane but once in seven years. The planter is never harassed by fears of having his crop injured or destroyed by the sudden advent of cold weather.

Besides cane and rice, tobacco, cotton, jute, indigo, and the whole series of tropical and semi-tropical fruits can be successfully and profitably cultivated.

The soils and situation of this region are such that the entire range of vegetables can be put into Northern markets before the truckers around Boston, New York, and Chicago have commenced to break their ground for the reception of seed. In this respect this region has no rivals in this country, and can compete with the Bermudas and Bahamas. The increase of wealth and the growth of luxury in the United States have created a steady and growing demand for table dainties, and the prices paid for fruits and vegetables out of their usual season are largely renumerative. Tomatoes, English pease, string beans, egg-plants, okra, and other garden products can be shipped from this section during the entire winter—from December to April. In the cultivation of such articles there is a mine of wealth opened to the enterprising and industrious settler. But little heavy clothing, and scarcely any fuel, except for culinary purposes, is required in this genial climate, so that there is a great saving in these items, so costly in a more rigorous latitude.

The question of transportation, which has heretofore been a barrier to the occupation of this desirable country, is about to have an early and satisfactory solution. By the time this report will be given to the public a line of steamers will be in operation upon the Kissimmee River, connecting Lake Okeechobee with the new city of Kissimmee, recently laid out on Lake Tahopekaliga, in Orange County. Here a junction is effected with the South Florida Railroad, a line stretching from Sanford, on the Saint John's River, to Tampa and Charlotte Harbor. Communication will also be had with the West as soon as the Caloosahatchee River is open to navigation.

A company was chartered by special act of the legislature of Florida, March 8, 1881, for the purpose of purchasing and improving certain tracts of land in Florida, the building of canals and other lines of transportation, and the carrying on of all other business incidental thereto.

The following information is taken from a pamphlet recently published by the above company:

> This company has a concession from the board of internal improvement of the State of Florida for the reclamation of all the lands lying south of townships 24 and east of Peace Creek, this area containing upwards of 8,000,000 acres.
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> The United States survey, made in 1879 by Col. J. L. Meigs, established the elevation of Lake Hickpochee, adjoining Lake Okeechobee, as being 22 feet above mean low tide, and he recommended the construction of a drainage canal similar to that now proposed to be established. These surveys and observations have recently been verified by a corps of engineers in the employ of this company, who found Lake Okeechobee to be 25 feet above tide water.
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> Lake Okeechobee, situate about the center of this 8,000,000 acre tract, is upwards of 40 miles in length by 25 miles in width, or covering an area of over 1,000 square miles. It has an outlet, but receives the drainage of a number of lakes intercepted by the Kissimmee River, also the waters of Fish Eating, Taylor's, and Mosquito Creeks, which vary from 20 to 150 feet in width. During very heavy falls of rain, this lake rises to such a point as to not only overflow its banks, but to cause the waters of the rivers to be backed up, so that the country becomes more or less submerged, until the waters find the ocean and gulf through the tortuous and inefficient channels of widely-separated streams.
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> It is proposed to provide against these periodical overflows by the opening of canals from Okeechobee to the Saint Lucie and Caloosahatchee Rivers that will not only permanently lower the level of the lake, but at all times furnish a safe outlet to the gulf and ocean for the waters of the lake and confluent streams, and which will also afford means of transportation for the products of the Kissimmee Valley and surrounding country.
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> The reclamation of the land included in that portion of the peninsula of Florida south of latitude 28° 15′ N., and generally east of Pease Creek, embraced in the counties of Monroe (5,000 square miles), Dade (5,000 square miles), Brevard (4,000 square miles), and portions of Manatee (5,000 square miles), and Polk (1,900 square miles), is a problem the magnitude of which can be more readily comprehended when we con-

sider that the territory in question covers 1,000 square miles in excess of the combined area of the States of Rhode Island (1,300 square miles), Connecticut (4,700 square miles), New Jersey (8,300 square miles), and Delaware (2,120 square miles). In other words, over 17,000 square miles of the most tropical portion of the most tropical State in the Union are to-day ready to respond to an intelligent, systematic, and properly directed effort towards placing them in the category of tillable and available acres, embracing no barren prairies nor mountain wastes. There are but few acres not susceptible to a high degree of cultivation. Lands which in a more northern climate would be regarded as valueless will here yield luxuriant and remunerative crops. For example, the scrub palmetto or poorest pine barrens of Southern Florida will produce, without fertilizers, large crops of Sisal hemp, yielding a profit to the acre which compares favorably with the returns from the richest land when cultivated in sugar tobacco, or cotton. The same character of land will produce from 50 to 75 bushels of upland rice to the acre—a three months' crop; or at a trifling original outlay, 15,000 pineapple slips, set to the acre, will, from the poorest scrub land, yield a return far in excess of the brightest dream of the Northern farmer. Other valuable tropical products adapted to these lands could be mentioned, which, in a more northern climate, would yield nothing to agriculture. This glance at the possibilities to be realized from the cultivation of third-rate pine and stunted "Black Jack" lands prepares us somewhat for a better appreciation of the capabilities of the soil designated as "rich lands," and named in the following order: First, "swamp lands"; second, "low hammock"; third, "high hammock"; and fourth, "first rate pine, oak, and hickory lands." It will only be necessary to call attention to the fact that the "swamp"—or lands subject to overflow—are intrinsically the most valuable lands in Florida. To adapt them for successful cultivation a systematic plan for their drainage will be indispensable; when thus prepared their inexhaustible fertility sustains a succession of the most exhaustive crops with astonishing vigor. The greatest yield of sugar ever realized in Florida (4 hogsheads per acre) was produced on this description of land.

It will be impossible to form or convey an adequate idea of the importance and extent of this enterprise, developing, as a consequence, a new and vast territory unlimited in resources, and of such material and varied agricultural wealth as can be furnished by no other State in the Union; opening to cultivation a tract of sugar lands the soil of which is identical to that of Cuba and Louisiana of a productive power apparently inexhaustible and unequaled in area by any country on the globe The prominent natural requisites to the growth and maturity of the sugar cane under the most favorable conditions, obtain here in a marked degree.

A moderate proximity of these lands to the sea and gulf, a dry, warm spring, showers during the afternoons in June, July, and August, followed by a comparatively dry autumn, a condition necessary for converting the starch into saccharine matter, are characteristics of the peninsula of Florida south of the 28th parallel of latitude. The importance of this one crop as affecting the material wealth of our country can be more readily comprehended by a bare comparison with the enormous output in precious metals from our western mines, those great store-houses of national wealth. The import duties on sugar for manufacturing purposes from the year 1847 to 1879 varied from 2½ to 4 cents per pound. We paid out for sugar and allied products during this period $1,800,000,000. Our western mines produced $1,700,000,000, or, in other words, during a period of thirty-two years as a nation we paid out in round numbers $100,000,000 in excess of the total output in bullion of our famed bonanzas of the west for an article of consumption every pound of which could have been produced from the soil of Southern Florida.

The choice sugar lands of Louisiana are rated at from $100 to $150 per acre, similar in character to those just described, which mature the cane to perfection, and are located below the frost line.

The terms of the contract with the board of internal improvement of the State of Florida give to this company one-half of all the land reclaimed by the lowering of the waters of Lake Okeechobee.

The peculiar characteristics of the coraline foundation upon which the peninsula of Florida has, by a gradual and cumulative process, been raised to its present level above the waters of the ocean; the configuration of its surface and that other marked geographical feature as indicated by the enormous extent of her coast line, exceeding 1,100 miles on the Gulf and Atlantic, indented by numerous large bays and estuaries; the uniform width of the lower portion of the peninsula and comparative short distance separating the waters of the Gulf and Atlantic; taken in connection with the successive slight ridges or table lands, generally parallel with the coast line, comprehending within their borders long reaches of savanna, prairie, and marsh, and increasing in altitude as we proceed towards the interior or water-shed of the Kissimmee River, whose flows empties into that grand island reservoir, Lake Okeechobee—we have before us the necessary data upon which to develop the plan for the solution of the problem of successfully draining and reclaiming this vast territory of notably rich lands.

An analysis of the soil taken from the saw-grass marsh on the border of Lake Okeechobee, by the distinguished Dr. Rogers, professor of chemistry in University of Pennsylvania, gives the following results:

Organic matter (vegetable mold)	55.00
Silica	21.80
Carbonate of lime	21.50
Iron, a trace	0.00
Water, not volatilized at 212°	1.70
	100.00

As the operations now in progress promise to add an immense area, comprehending no less than 18,000 square miles of the very richest and most productive lands to the agricultural resources of the country, all matters connected with this vast enterprise contain information of the greatest importance.

Col. Ingham Coryell, general superintendent of the Atlantic and Gulf Coast Canal and Okeechobee Land Company, furnishes the following information relative to the plans and points of operation for the proposed drainage of Okeechobee:

> We have been at work for the past two months, under the supervision and direction of Capt. F. A. Hendry, in cutting a channel from the headwaters of the Caloosahatchee to Lake Hickpochee, and have succeeded in opening one 20 feet wide, and now having a depth of 3 feet. His report is that it is daily deepening, and so soon as the waters lower in Okeechobee, what is now a marsh overflow will be concentrated from Hickpochee in the channel as now made. It will cut very fast, and thereby enable the dredge-boat, nearly finished, at Cedar Key, on its arrival on the Caloosahatchee, to be forced up and over the 16-foot elevation into Hickpochee. When there we are 3 miles from Okeechobee, with only 2¼ feet elevation to overcome to get into that lake, which is entirely practicable. By taking the dredge by a circuitous route, throwing our excavation in our rear as we proceed, we dam up our passage *en route*, as far as soft mud and vegetable growth will obstruct the passage of water.
>
> It is not our intention to open a flood on the valley of the Caloosahatchee, and we will use every means to prevent it. Our objective point of operations will be on the southeast end of Lake Okeechobee, where our first cuttings will commence. We are now building a second dredge on Lake Tohopokaliga, which is the head of the Kissimmee River, in Orange County, at the newly laid-out city of Kissimmee, and a short cut of 2 miles at the southwest corner of that lake into Reedy Creek will afford

us plenty of water; thence into the Kissimmee River down to Okeechobee, where we hope to join the Cedar Key dredge, and carry both to the southeast side of Okeechobee. The Cedar Key dredge has a cutting capacity of 22 feet wide and 10 feet depth.

The Tohopokaliga dredge will have a cutting capacity of 25 feet and over, and 10 feet depth. Both dredges have stern wheels and are self-propelling. At the southeast side of Okeechobee there is an open slough from 4 to 6 miles in length, and evidently at one time an open river, heading in the lake and emptying into the Atlantic at Miami, New Hillsborough, or some other river now carrying the surplus waters of the Everglades, reaching their head, into the ocean.

Further investigation may cause us to utilize this open slough as one of the points to commence our cutting, which will first be by a cut 4 feet deep and the width of the full capacity of our dredge. The other dredge will commence near by, and will converge to a point, say 4 miles from the lake, where they will meet, and to which point other cuts will be made if found necessary, concentrating the water and flows, and the force thus concentrated will possibly cut its own channel from that point southeast to the ocean. It will at least go somewhere on the down grade, and be gotten rid of in a direction where no damage will be done to any one. As to the extent of the openings to be made, I don't think it is within the power of engineering science to determine by a survey and calculation. We can calculate the surface level of Okeechobee to the depth of one foot to contain 31,363,200,000 cubic feet of water, and the lowering of the lake one foot reduces its contents fully one-fifth of its entire capacity and from its shallowness will expose or reclaim possibly over one mile of its entire border; hence the cubic feet of water by the next reduction of one foot will be very materially lessened, and so on by every foot of reduction. A reduction of one foot solves the problem. We have measured the inflow at the mouth of the Kissimmee, when the waters were within its natural banks, but during a flood, its spread is for miles east and west over a saw-grass marsh, and impracticable to measure with any certainty for several reasons, the principal of which is the irregularity of the flow at points through the saw grass, where greater or less obstructions exist. For this reason, no actual calculation can be made of what cuts in area are required, but we are reduced to and forced to accept the general positive requirement of making "the outflow greater than the inflow to prevent overflow." The reduction of the lake one, two, or three feet will form a reservoir that will prevent an overflow during an unusual rainfall, even if the outflow should not be fully equal to an unusual rainfall and inflow, and will prevent an overflow.

One important and encouraging point in success of the enterprise is the fact that we meet with no rock, hard pan, or clay obstruction, and the cutting through the mud formation by the force of water concentrated must be very great, and it is reasonable to suppose will cut and deepen its own channel. Tests by the sounding rod have been made from the Caloosahatchee up to and through Hickpochee, and thence to Okeechobee, and on the Atlantic side from Lake Worth, for a distance sufficient to know that no rock or hard pan exist to a depth that will reach the bottom level of Okeechobee. Of this there can be no question. You ask will the lowering of Okeechobee effect the whole of the drainage desired? By no means; the work is then only begun. The straightening of the channel of the Kissimmee must follow, and a series of drainage operations at other points, which space will not allow me to illustrate.

THE INDIAN RIVER AND LAKE WORTH REGION.

This interesting and attractive portion of the State is now engaging a large share of public attention, in consequence of the certainty that it will shortly be blessed with the advantages of cheap and rapid facilities for transportation. The eastern shore of this river is washed by that remarkable ocean current, the Gulf Stream, giving it at all seasons a uniform temperature, and very effectually protecting it against sudden falls of the thermometer. The orange grown in this region attains a perfection of richness and delicacy of flavor not found elsewhere, and brings the highest prices. Here seems to be the natural home of the pine-apple and cocoanut, and these fruits thrive and flourish in tropical luxuriance. Its waters abound in all the varieties of fish known in these latitudes, and also in the finest oysters, and that prized product of the sea, the green turtle. Here will be established almost certainly extensive fisheries and canneries for the preparation of these delicacies for distant markets, and such industries promise, in the near future, to attain large proportions.

To the devotee of the gun and fishing-rod this country opens a new and fertile field of operations. Game is found in the utmost profusion, and in the winter especially, when the migratory birds seek a milder climate, the abundance of fowls along the course of this river is wonderful. Bears, deer, wild turkeys, and ducks of all varieties abound, and birds of rare and beautiful plumage invite the attention of the taxidermist. When this section is opened, and suitable accommodations are provided, it is destined to become a favorite resort for sportsmen.

The same company that proposes to drain Lake Okeechobee and the everglades has also contracted with the State board of internal improvements to connect the waters of the Saint John's and Indian Rivers by a system of canals. The proper surveys have demonstrated the feasibility of the proposed plan, and it is expected that the work will be commenced at no very distant period. When completed, this enterprise will open 330 miles of safe inland navigation, extending from Lake Worth on the south to the mouth of the Saint John's River on the north, at a point somewhere in the vicinity of Jacksonville.

From the pamphlet already quoted I take the following paragraphs:

> This company has acquired by purchase the franchise of the Atlantic Coast Steamboat, Canal, and Improvement Company for the construction of a canal, suitable for commodious light-draft steamboats, commencing at the Saint John's River, extending thence in a southerly direction, connecting Pablo Creek, San Diego, Mantanzas, Halifax, and Hillsborough Rivers, Mosquito Lagoon, Indian River, Saint Lucie Sound, Jupiter River, and Lake Worth, thus affording nearly 330 miles of continuous navigable inland waters, lying adjacent to and generally parallel with the east coast of Florida, being separated from the ocean by peninsulas and extended narrow islands; these natural barriers guaranteeing a safe and continuous navigation throughout the entire year. The water is salt, being constantly renewed from the inlets at Saint Augustine, Mantanzas, Mosquito Lagoon, Indian River, and Lake Worth. These inland waters affording at present an almost unbroken line of communication, may, at a reasonably moderate expenditure in systematic construction, presenting no embarrassing engineering problems, be developed into a grand canal possessing features peculiarly its own. Merely where the artificial work of joining river to river is performed can it be regarded as a canal proper, as from these points it develops into those majestic arms of the sea, from 30 to 120 miles in length, varying from 1 to 6 miles in width, bordered on either side by a country generally well elevated, enjoying unbounded natural agricultural resources, a semi-tropical luxuriance in beauty of foliage, scenery of an exceedingly variegated and picturesque character, and blessed with a climate

throughout the entire year the most equable and salubrious enjoyed by any State in the Union. The soil is generally sandy, with an admixture of disintegrated coral and shell with alluvial and organic matter, capable of supporting successive crops without the aid of manure.

Large bodies of high and low hammock lands of palmetto, oak, bay, hickory, &c., extend along the shores, adjacent to which, on the west shore, are tracts of high open pine lands, bordered by prairie, savanna, and marsh. Experience demonstrates that the soil is not affected by drought in the same degree as other lands, nor does it suffer from too much rain, and, being exceedingly friable, requires no other preparation than grubbing and plowing to adapt it at once for the production of crops covering the widest scope, embracing tropical and semi-tropical fruits and fibrous plants in great variety, and maturing to that degree of perfection developed at no other point within the bounds of the United States.

The topographical features of the country will permit of a general alignment for the canal on the most direct route connecting the several rivers and navigable streams above alluded to. The method of performing the major part of the excavation will be by labor-saving appliances especially designed for this work, combining great efficiency with ease of manipulation and economy in power.

It will be impossible to form or convey an adequate idea of the importance and extent of this enterprise, developing, as a consequence, a new and vast territory, unlimited in resources, and of such material and varied agricultural wealth as can be furnished by no other State in the Union; opening to cultivation a tract of sugar lands, the soil of which is identical to that of Cuba and Louisiana, of a productive power apparently inexhaustible and unequaled in area by any country on the globe. The prominent natural requisites to the growth and maturity of the sugar cane under the most favorable conditions obtain here in a marked degree.

In view of the natural advantages generally cited, experience and statistics guarantee that continued health may be anticipated with as much confidence as in any other section of the country; lands, cheap and readily accessible, easy of tillage, from the fact that, owing to the friable character of the soil, cultivation is neither laborious nor expensive; the harvesting of crops covering the widest scope, embracing nearly all of the grains, fruits, and vegetables of the Northern, Middle, and Southern States; besides tropical and semi-tropical fruits and fibrous plants in great variety, and maturing to that degree of perfection developed at no other point within the bounds of the United States, or indeed anywhere north of Central America—it is fair to assume that immediately subsequent to its completion the unoccupied lands bordering the canal will be entered upon by those experienced in agriculture; capitalists, merchants, speculators, and all of the elements that enter into the thrift and prosperity of a new country will settle among its borders, forming the nucleus of future thriving villages, communities, and cities, constituting the pioneers of that great and inevitable people destined to populate and harvest from the rich prairie, savanna, and upland of the interior bountiful and staple crops, for the production of which nature for past cycles has been preparing the soil by the enriching process of growth and decay of a luxuriant vegetation.

As the cultivation of sugar will probably be the largest and most important industry of this region, it may not be amiss to insert a valuable article upon that subject from the pen of the well-known Dr. C. J. Kenworthy, of Jacksonville, from whose writings copious extracts have been previously taken:

The list of Florida productions is a long one, embracing nearly all the cereals, fruits, and vegetables of the Middle, Northern, and Southern States, as well as the fruits, vegetables, and medicinal and fibrous plants of semi-tropical and tropical countries. Since the settlement of the State the inhabitants have confined themselves to the culture of two or three crops, and old customs cling to the majority as do barnacles to the hull of a stranded vessel in a tropical sea.

Under English rule sugar cane proved a profitable crop, and for many years anterior to 1861 it was extensively and profitably grown by Hon. D. L. Yulee and others. For the successful culture of sugar cane a comparatively dry and warm spring, a high thermal range, coupled with frequent torrential showers, preceded and followed by sunshine during the summer, and a dry and warm fall and winter, are essential. These climatic conditions exist to an eminent degree in Southern Florida, as established by observations taken at Fort Myers, on the Caloosahatchee River, and at Fort Dallas, Cape Florida.

MEAN TEMPERATURE.

Stations.	Years and months.	Spring.	Summer.	Autumn.	Winter.	Year.
Fort Myers	4 0	75°.4	82°.4	77°.0	65°.3	75°.0
Fort Dallas	4 6	74°.7	81°.5	76°.3	66°.6	74°.7

Rainfall is an important factor in the growth and maturation of the cane; and the necessary hyetal conditions exist in the southern portion of this State.

RAINFALL IN INCHES AND HUNDREDTHS.

Stations.	Years.	Spring.	Summer.	Autumn.	Winter.	Year.
Fort Myers	4	11.07	31.61	11.09	8.33	62.91
Fort Peace, Ind. T	3	11.13	26.25	16.84	8.76	62.98

With a high thermal range and ample rainfall during the summer months, the cane attains a development rarely excelled in the West Indies. In the southern portion of the State it ratoons and tassels, and attains saccharine maturity. Even in the northern portion of the State it reaches a more perfect growth and development than in a large portion of Louisiana. We have seen it stated that from ten to fifteen ripened joints to a cane is deemed a good yield, and this can be excelled on the high sandy lands of the northern portion of the State. It is admitted that Cuba is the home of the cane, and that climatic conditions are the elements of its success. For the purpose of comparison we will give the mean temperature and rainfall at Havana:

	Years.	Spring.	Summer.	Autumn.	Winter.	Year.
Mean temperature	8	75°.7	84°.2	75°.5	68°.4	75°.9
Rainfall	5	7.5	14.23	11.48	6.54	39.76

From the data quoted, it will be seen that the rainfall at Havana is less than one-half as great as that at Fort Myers, and as a result the cane attains a greater development of stalk and amount of saccharine matter in Southern Florida than in Cuba. Even the mean annual temperature of Havana is but nine-tenths of a degree above that of Fort Myers. But the great advantage Southern Florida possesses over the West Indies is the excessive rainfall during the summer—frequent torrential showers followed by bright sunshine, with a high mean temperature, causing a luxuriant growth of cane that surprises the resident of the tropics.

With a duty of upwards of three cents per pound on imported sugar it is surprising that the culture of cane in Florida has been so long neglected, more especially when we take into consideration the fact that the people of the United States have paid more for sugar and its allied products since 1849 than the value of the precious metals produced by the mines of the Western States and Territories during the same period.

Sugar-cane is extensively cultivated in Louisiana, but the climatic conditions are not as favorable as those of Florida. For the perfect maturation of the cane it is admitted that an annual mean temperature of 75° F. is necessary. As a rule, in the former State the summer rains are insufficient for vigorous growth except in the lowlands; the occurrence of cold rains during the autumn, early frosts, and a low thermal range in the autumn seriously interfere with the vito-chemical action necessary to change the starch into sugar. Taking New Orleans as a point of comparison, we find the temperature and rainfall to be:

	Years.	Spring.	Summer.	Autumn.	Winter.	Year.
Temperature	39	68°. 9	80°. 9	69°. 3	55°. 7	68°.7
Rainfall	39	11. 8	15. 9	11. 2	12. 3	50.7

In Southern Florida the cane need not be ground until after Christmas, but to escape early frosts in Louisiana they are compelled to crush it before it is matured. In a New Orleans paper of recent date, we find the following: "Many plantations are grinding, but the cane is somewhat too green yet. Estimates based on reports from a large number of plantations promise a yield of about 136,000 hogsheads, a falling off of four-tenths as compared with last year." Even with this diminished yield the State will receive over $15,000,000 for its sugar crop, and these and many more millions should be made to enrich Florida.

In Louisiana it is necessary to cultivate the cane on the low alluvial soils, but owing to the rainfall in this State during the summer the cane will yield large crops on high and even sandy lands. In his work on Florida, published in 1823, Vignoles remarked:

"Respecting sugar, the recent successful trials that have been made upon it have determined the curious fact that it will grow in almost any of the soils of Florida south of the mouth of the Saint John's River. The great length of summer, or period of absolute elevation of the thermometer above the freezing point, allows the cane to ripen much higher than in Louisiana."

From the best information we have been able to obtain, the cane produced in Duval County on elevated lands is larger, longer, and more perfectly ripened than the product of Louisiana. We have examined cane grown on the Indian River which had from forty-six to fifty-four ripened joints. In the beginning of this year Professor MacCauly, of the Smithsonian Institution, visited the Indian camp in the Big Cypress, 60 miles east of Fort Myers. On his return he informed me that the Indians were engaged making sugar, and that the ripened cane-stalks would measure from 18 to 22 feet in length.

Vignoles says: "Perhaps it may be thought that Florida presents but little to tempt the large sugar planter; granted, but it is undoubted, if the culture of the cane should be adopted on a small scale, by the same proportionate number of cultivators that are in the habit of raising cotton in Carolina, Georgia, and Alabama, their labor would be amply repaid and a source of wealth opened; particularly should some public-spirited and enterprising individual establish, at central and eligible points, sugar-mills to receive the small crops, precisely on the same principle that cotton-gins and rice-mills exist in Southern States. This would augment the population and increase the resources of the country sooner and better perhaps than any other mode."

If the establishment of sugar-mills at central and accessible points was desirable in 1823, it is more so in 1881. For years I have advocated the erection of a large sugar mill and refinery in Jacksonville, where cane can be supplied by small growers and converted into sugar and molasses. Land and labor are cheap, taxes are low in the country, firewood at the saw-mills is costless, and instead of consuming sugar grown in Louisiana and Cuba we should produce enough for home consumption and a half million hogsheads for exportation. With a suitable climate and soil, coupled with cheap labor and an opportunity to obtain a supply of cane on reasonable terms, it seems farcical that Floridians should consume sugar produced within one hundred miles of the State; pay the freight from Cuba to New York, an import duty at the rate of on No. 13 to 16 sugar, $3\frac{7}{16}$ cents, and on No. 16 to 20, $4\frac{1}{16}$ cents per pound; the cost of refining in a Northern city, where labor is high, and where firewood and coal are expensive, coupled with freights, commissions, profits, &c. There may not be "millions in it," but there is a profitable investment for some person who will erect a sugar mill and refinery in Jacksonville. If a market could be found for cane, its production would be insured, and thousands of persons would engage in its cultivation; the young orange grower, small farmer, and the owners of small patches and town lots would plant it, and an ample supply for a mill and refinery could be secured. This city is connected by river or railroad communication with every portion of the State, and with low freights the cane could be shipped from distant points. Or, to avoid the cost of transportation of cane, producers at a distance could press the cane, barrel the juice, add the milk of lime, and ship it to its destination. The superannuated third-class machinery at present used in the State consigns nearly one-half of the juice of the cane to the bagasse heap; hence an annual monetary loss. The central factory system, with perfect machinery, would materially increase the yield of sugar from the cane produced. From the best information before me I have reason to believe that a central mill could afford to pay the producer $4 per ton for the cane, and he would find it a more profitable crop than cotton. A central factory means a divorce of the agricultural part of the sugar production from the manufacturing, mercantile, and financial part, and that it would prove a profitable investment we are assured. In 1858 the growers in Louisiana produced 1,124,592 hogsheads of sugar, worth $120,000,000; and if this can be done in the unsuitable climate of Louisiana, the question arises, what can be done in Florida with her soil and climatic advantages? We might furnish many facts and figures relating to this industry, but space says, hold, enough.

ORANGE CULTURE.

This is one of the industries of Florida that has suddenly attained very considerable proportions. From barely nothing, in a commercial sense, at the close of the war, the business has grown to be worth $1,000,000 in 1880. Measured by the progress of the past, it is destined to become, in a very short time, one of the leading industries of the State. Last year there were exported at least 45,000,000 of oranges. The business so far has been very successful, and is daily inviting more capital and enterprise. There is already $10,000,000 invested in orange groves in the State, with a field open for the profitable employment of $50,000,000 more. Lands suitable for growing oranges are in abundance and at low prices. Orange groves can be found in almost every part of the State, and on all varieties of soil well drained, the groves numbering each from 10 to 10,000 trees. Hardly a family outside of the cities but cultivates a greater or less number of orange trees, and many residing in the cities do the same. Some of the largest groves in the State are owned by persons living in the towns, or by non-residents. In some of the counties there were raised as high as from 4,000,000 to 6,000,000 of oranges last year; and narrow-gauge railroads are rapidly being built to afford the middle counties facilities for shipping their enormous crops to market. Three such roads have been completed within the past few months, and others are projected, while more are under contemplation. Oranges are shipped from off these roads to New York in eighty and ninety hours' time.

Within the past few years orange culture in Florida has also attained great perfection. It has reached that position where it is possible to analyze the cost of production. Abundant evidence exists that can be brought forward to show the value and profit in it for the investment of capital. Results have shown that there is not at present any pursuit, where the tilling of the soil is involved, that will yield larger returns with less fluctuation. It is always pleasant to be able to confirm such statements with facts. An extensive orange grower in Putnam County has kept, from the beginning of his grove, an accurate account of the expenditures and receipts to the close of the thirteenth year, ending 1879. The number of trees were 300. They yielded 442,600 oranges, selling for $7,590, as against an expenditure, omitting cost of land, first cost of trees, and interest on the money, of $1,950. This gives receipts over expenditures, $5,640. This is only one instance, but it is as good as many, because it is only one in a very large number. It conclusively demonstrates that orange culture is not at all transitory. Nearly all the obstacles in the path of orange culture have been removed.

The future of the business is still more promising. Florida oranges are conceded to be superior to all others. In point of numbers, compared to the great quantities consumed, they are few; yet by their greater merit they have come to occupy the foremost place in the market. The genial climate and peculiar soil of Florida, together with sufficiently warm sun to mature and concentrate the juices without destroying the lively aromatic flavor of the fruit, impart this quality—a value nowhere else attainable to such an extent. The field they are yet to occupy is practically illimitable. They are yet to possess our own market, the best in the world. This will be the labor of years, and after a great portion of our orange lands have been brought under cultivation. In 1879, there were 257,000,000 of oranges entered at the port of New York alone from foreign countries. Double the number, at least, were entered at all the other ports, making a grand total of 771,000,000 consumed in and lost on the voyage to this country, in addition to our Florida crop. We cannot predict when the domestic will take the place of the foreign product, but it is inevitable in course of time. Our inability to supply the demand is the main obstacle.

That this will be the ultimate result is clear from another cause, independent, or nearly so, of merit. The liability of loss and damage resulting from uncertainties of a sea voyage forms an important factor in the conduct of the foreign fruit-trade, serving to make it extremely hazardous—a circumstance against which dealers do not have to contend in the shipment of Florida oranges. We have railroads leading to all the great markets in America, and when the fruit is transported by water, all the facilities are afforded by perfect and commodious steamships.

Orange culture, therefore, may go on indefinitely in Florida, without fear of reaching a general redundance of product. When our own market is occupied those of Europe and elsewhere will be open to us. The growing desire everywhere, also, of people for semi-tropical fruits, which the efforts of producers are trying to satisfy, is unlimited, and, therefore, efforts in orange culture can continue to be put forth until this unlimited and independent desire is met—a goal which, perhaps, never can be reached.

To persons of foresight and capital, who are looking to the future rather than the present for remunerative returns, Florida presents, in her orange pursuit, the most extended as well as the most inviting field. But aside from the question of profit the culture of oranges presents other practical advantages. It is not only a pleasing but an independent occupation. Its pursuit is no dead level of monotonous exertion, but one that affords scope for the development of an ingenious mind. As a producer, the orange grower is working under conditions of constantly increasing advantages. Young men, sometimes with little or no capital, are starting every year in the business, often away from communities of old and experienced growers, and have succeeded by dint of tact and industry. In point of regular profits; in point of an industrious, frugal, and cheerful occupation; in point of a very general desire to become independent; in point of success and freedom from penury, and in point of repressive and adverse influences in other pursuits, they have found orange culture, and its practical workings, the most pleasing of occupations. Persons who own groves in Florida are entirely well satisfied, as a rule, with their investments. A bearing grove is worth a great deal of money, and to purchase one would require a large cash outlay. In ten years' time groves are usually in full bearing—often in less time—and the inducement to plant one is very great.

Finally, we would say, that the motives that induce men to labor in Florida are the same as in other States—for profit; and if the energy and persistence of the work be proportionate to the constancy and press of the motives, then will they most certainly succeed, and make the aggregate profit of their investment equal, if it does not exceed, that of nearly all other pursuits involving no greater outlay of money. Moreover, the occupation of orange-growing has a tendency to make one hopeful for the future. The tilling, too, of the soil immeasurably improves the character of the cultivator. Add to this the beauty of the country and climate, and the attractions of country life; the tranquillity of mind which they promise, and the enjoyments which they really afford; the charm of proprietorship and self-guiding exertion, and the buoyancy of outdoor employment, and we have all the essentials for acquiring health and happiness, as well as independence.

WHAT THE POOR IMMIGRANT MAY DO.

In previous pages we briefly made some remarks as to new-comers. We believe that a plain relation of what may be reasonably assured to the poor as well as rich immigrant will be received as useful information. Florida is no exception to other countries, and the present but repeats the past in the various phases of immigration. The early colonists and colonies in America, the periodical and frequent later immigration to new States and Territories, and from old to new localities, all have had experiences, good, bad, and indifferent, yet we find, after a brief period, that the new countries are filled up with a prosperous and contented population. It is not necessary to review the varied causes of this universal experience; although the local historian may dwell upon them, the new generations of the present look forward and not back. The characteristics of Florida, general and special, we have truthfully noted; other things being equal, the climate, soil, health, cheapness of lands, staple and special productions, easy access and egress by land and water, form of government, low taxes, a small State debt, all present superior advantages, especially for the poor, or those in moderate circumstances, for securing a good home. At the outset, however, the immigrant asks, how shall I at once procure a support for myself and family? Now, premising that the new-comer means to work—intends to stay—he can go to work at once and raise food from the soil. New pine lands, broken up with the grass turned in, will grow good crops of sweet potatoes and cow pease, with but slight cultivation. These crops in, fields inclosed, the grass covered soon becomes rotted, and the soil easily worked. Corn, cane, and cotton may now be planted, as also vegetables; in the same field and with the crops, orange, lemon, and other fruit trees may be planted, where they are to remain, at regular distances apart, both ways. The vineyard may also be put out, as well as smaller fruit, about the premises. The pea-vines, with pease, will afford forage for stock; pease and potatoes for food. Succeeding the pease and potatoes, turnips and onions, beets, cabbage, and similar semi-hardy vegetables may be grown from the late summer to the next late spring months, nearly the year round. The immigrant can easily gather about him hogs, which will range for their own living, potatoes being fed to them in the fall. Poultry are no care for feed or support; game and fish are to be had for the seeking. It will be seen that the food question is easily solved. Year by year his crops are increasing, his comforts added to; he has within himself the accessories of a comfortable home. In the meantime his grove of oranges, lemons, his vines, are growing apace; in a few short years he scents in the early spring the sweet odor of the orange bloom, sees the green fruit gradually increasing in size, and, as autumn months come on, gladdens his eyes with the sight of the golden fruit which now will yield him a substantial return—waited for and won. It has taken less than half a score of years for the piney-woods pioneer to make a new home which yields him ample support and sure increasing income for the future.

WHAT THE RICH IMMIGRANT CAN DO.

To the man of capital, Florida offers a large variety of specialties to employ it surely and profitably, whether as an investment looking to the future for increase, or present employment and quick returns. There are millions of acres of United States, State, and railroad lands, Spanish grants of large areas, and private improved and unimproved lands, which can now be bought cheaply. These comprise timber lands, which are increasing in growth and value every year, also improved lands already cleared and ready to cultivate, now unoccupied by reason of death of owners, or want of means to hire labor and purchase stock. A few thousand dollars judiciously invested in lands would be sure to pay a profit. Manufactories of cotton, and cotton-seed oil mills, starch factories, rice mills, paper mills, tanneries, saw mills, furniture shops, &c., offer good opportunities for present profit.

There are many good openings for mercantile business, purchasing the staples of the country, such as cotton, sugar, sirup, naval stores. Fruit raising on a large scale can be done with assured profit; with means, one can have hundreds of acres in trees, and millions of oranges and lemons to sell or ship. The shrewd real estate dealer can buy and sell at a profit; the money-lender loan at high interest, with ample security. All this has been done, is done, and doing now. If the capitalist would desire to farm on a large scale, no better field than here. There are hundreds of large plantations in Middle Florida, lying contiguous, which can be bought low, and a farm of 100 to 10,000 acres can be made, and planted in cotton, cane, corn, rice, tobacco, and other crops. Labor is plenty and cheap, crops sure and good, always in demand, and fair prices rule.

HOMESTEAD AND OTHER EXEMPTIONS.

One hundred and sixty acres, or one-half acre of land within city or town, owned by the head of a family residing in the State, together with $1,000 of personal property, and the improvements on the real estate, shall be exempted from any forced sale under any process of law; and real estate shall not be alienable without the joint written consent of wife and husband. In addition to the above exemption, there shall be exempted from sale by any legal process, to the head of a family, one thousand dollars in any kind of property which said head of family may select, in cases where the indebtedness was contracted or judgment obtained before the 10th day of May, 1865. Taxes can only be levied for State, county, and municipal purposes. Married women are protected by law in the ownership and control of property separate and apart from the husband.

WHO MAY VOTE.

Every male person twenty-one years of age, who shall be, or shal have declared his intention to become, a citizen of the United States has resided in the State one year, and in the county six months, ma vote in the election district where registered. Bribery, perjury, larceny wagers on election, fighting a duel or accepting a challenge, disfranchises

Table showing the mortality and population of the State of Florida for the year ending Ja 1, 1880, as returned to the Census Bureau at Washington, D. C., and also the deaths fro consumption and other pulmonary diseases for the same period.

Counties.	Total mortality.	Deaths from consumption.*	Deaths from pulmonary diseases other than phthisis.	Total population, 1880.
Alachua	68	1	3	18,5
Baker	7	0	0	2,3
Bradford	30	3	0	6,1
Brevard	12	1	0	1,4
Calhoun	19	0	2	1,5
Clay	46	5	0	2,7
Columbia	91	2	8	9,5
Dade	3	0	0	19
Duval	234	34	11	17,7
Escambia	107	17	3	12,21
Franklin	15	1	0	1,74
Gadsden	191	8	10	11,5
Hamilton	81	3	1	6,4
Hernando	0	0	0	4,2
Hillsborough	40	5	1	5,8
Holmes	28	1	3	2,77
Jackson	182	3	22	14,4
Jefferson	153	10	14	16,1
La Fayette	11	0	0	2,6
Leon	282	8	3	20,3
Levy	78	7	2	5,77
Liberty	15	1	0	1,2
Madison	134	5	10	15,11
Manatee	0	0	0	3,67
Marion	88	4	2	13,0
Monroe	62	4	3	10,9
Nassau	67	6	1	6,546
Orange	35	6	5	6,19
Polk	28	1	4	3,15
Putnam	53	6	3	6,25
Santa Rosa	19	2	4	6,701
Sumter	37	0	0	6,07
Saint John's	58	14	5	4,5
Suwannee	91	5	4	7,37
Taylor	45	1	3	2,
Volusia	31	0	1	3,40
Wakulla	11	0	0	2,75
Walton	31	0	1	4,27
Washington	31	0	2	3,23
Total	2,514	164	141	271,86

Total deaths in 1,000 of all ages	9
Total deaths from consumption in 1,000 of all ages	6.10
Total deaths from other pulmonary diseases in 1,000	5.10

*A large proportion of the deaths from consumption are cases of invalids from other States and countries.

Table showing the population of Florida by race, as returned to the Census Bureau at Washington, D. C., June 8, 1880.

Counties.	White.	Colored.	Total.
Alachua	8, 093	10, 604	18, 697
Baker	1, 682	630	2, 312
Bradford	4, 895	1, 272	6, 167
Brevard	1, 424	62	1, 486
Calhoun	979	396	1, 375
Clay	2, 170	585	2, 755
Columbia	4, 818	4, 776	9, 594
Dade	193	2	195
Duval	7, 801	9, 961	17, 762
Escambia	6, 988	5, 229	12, 217
Franklin	1, 185	556	1, 741
Gadsden	4, 072	7, 516	11, 588
Hamilton	4, 334	2, 152	6, 486
Hernando	3, 359	895	4, 254
Hillsborough	5, 011	877	5, 888
Holmes	2, 671	103	2, 774
Jackson	5, 391	9, 096	14, 487
Jefferson	3, 393	12, 733	16, 126
La Fayette	2, 442	158	2, 600
Leon	3, 440	16, 885	20, 325
Levy	3, 928	1, 848	5, 776
Liberty	711	526	1, 237
Madison	5, 656	9, 462	15, 118
Manatee	3, 561	113	3, 674
Marion	3, 201	9, 799	13, 000
Monroe	7, 668	3, 259	10, 927
Nassau	2, 473	4, 073	6, 546
Orange	5, 494	696	6, 190
Polk	3, 036	120	3, 156
Putnam	3, 931	2, 319	6, 250
Santa Rosa	4, 749	1, 952	6, 701
Sumter	4, 993	1, 079	6, 072
Saint John's	3, 242	1, 353	4, 595
Suwannee	4, 166	3, 213	7, 379
Taylor	2, 118	162	2, 280
Volusia	2, 889	518	3, 407
Wakulla	1, 460	1, 290	2, 750
Walton	3, 790	480	4, 270
Washington	2, 380	858	3, 238
Total	143, 877	127, 987	271, 864

Population in 1870	187, 748
Increase in ten years	84, 116

Statistics of the State of Florida.

[Compiled by S. U. Hammond, esq., of Fort Gates, from the United States census returns, June 1, 1880, showing the number of acres under cultivation and the amount of leading productions for the year 1879, together with number and value of live stock, &c.]

Counties.	Land tilled.	Farm values.	Live stock.	Farm productions.	Number of horses and mules.	Number cattle.	Number swine.	Rice.	Corn.	Oats.	Cotton.	Molasses.	Peaches.	Potatoes.	Garden produce sold.	Honey.
	Acres.							*Lbs.*	*Bush.*	*Bush.*	*Bales.*	*Galls.*	*Bush.*	*Bush.*		*Lbs.*
Alachua	49, 771	$791, 860	$227, 515	$539, 433	2, 682	8, 420	11, 245	107, 400	258, 040	2, 040	2, 911	107, 210	7, 450	127, 290	$41, 355	
Baker	4, 877	77, 575	53, 935	53, 650	313	7, 432	4, 492	29, 535	25, 507	2, 494	206	4, 242	7, 315	10, 720		2, 245
Bradford	16, 125	231, 797	117, 813	180, 010	875	4, 513	9, 096	36, 000	79, 540	4, 800		7, 700	10, 400	34, 720		
Brevard	1, 950	310, 355	171, 367	46, 840	190	22, 338	2, 400	22, 010						20, 230	3, 949	3, 210
Calhoun	4, 366	295, 775	42, 637	45, 972	248	5, 702	2, 974	21, 570	21, 980	2, 393	149	10, 590	1, 337	22, 370		12, 343
Clay	3, 871	95, 550	45, 050	63, 325	326	2, 651	4, 439		12, 012		86	3, 425		14, 540		
Columbia	33, 996	371, 290	190, 217	317, 825	1, 515	8, 762	9, 797	65, 705	70, 751	4, 184	129	7, 361	10, 300	41, 740		1, 230
Dade (no returns)																
Duval	4, 200	811, 745	166, 031	43, 125	423	3, 738	3, 254	16, 775	9, 802		288	7, 393	3, 805	25, 875	13, 544	3, 085
Escambia	1, 963	112, 725	23, 355	31, 000	507	4, 339	2, 309						6, 000	15, 305		10, 000
Franklin		20, 750	13, 305	10, 580	18	1, 869	1, 318		1, 761			13, 630		19, 270		2, 000
Gadsden	76, 997	767, 514	166, 696	459, 710	2, 461	14, 829	9, 587	41, 400	133, 325	27, 150	5, 372	53, 660	1, 320	75, 845		24, 400
Hamilton	40, 024	453, 335	157, 451	190, 680	857	10, 473	10, 493	130, 516	110, 888	21, 393	1, 867	14, 703	2, 340	33, 339	1, 520	9, 894
Hernando	12, 720	378, 000	213, 600	207, 000	1, 680	24, 960	28, 200	90, 000	93, 000	20, 400	420	36, 000		120, 000		6, 400
Hillsborough	11, 447	1, 046, 265			940	17, 219	9, 595	11, 000	55, 690	205	365	9, 321		68, 267		12, 370
Holmes	7, 040	49, 210	56, 840	44, 240	675	3, 020	9, 000	198, 000	57, 000	5, 000	320	35, 200	4, 200	31, 600		30, 400
Jackson	128, 406	1, 173, 400	409, 276	1, 908, 481	3, 259	12, 966	29, 467	72, 220	407, 722	65, 412	11, 585	55, 780		105, 875		2, 400
Jefferson	89, 930	2, 280, 070	201, 657	736, 618	2, 208	7, 284	12, 512	8, 409	359, 704		8, 728	67, 396		97, 484		2, 135
La Fayette	7, 782	92, 630	80, 143	50, 220	2, 088	12, 417	4, 778							11, 833		
Leon	104, 047	863, 376	196, 656	603, 190	3, 031	6, 043	12, 054	5, 545	326, 684	29, 986	9, 072	63, 988	2, 865	114, 107		3, 780
Levy	15, 523	268, 360	146, 315	149, 810	960	7, 486	5, 144		45, 386	16, 840	440	31, 240		48, 200	10, 000	
Liberty	3, 863	67, 773	44, 012	55, 779	163	5, 330	3, 125	24, 825	16. 285	5, 756	440	110, 991		13, 272		
Madison	61, 910	908, 450	211, 000	681, 695	2, 994	13, 427	17, 028	10, 000	343, 050	48, 040	6, 773	103, 611		107, 999		6, 000
Manatee	3, 360	384, 000	912, 000	177, 600	1, 460	190, 650	8, 400							85, 400		14, 400
Marion	49, 794	1, 113, 000	44, 012	292, 588	2, 213	17, 402	10, 274	18, 380	187, 255	4, 400	2, 870	33, 876		79, 215		2, 025
Monroe	906	111, 000	12, 600	19, 200	170	5, 700	3, 108					12, 000		5, 400		
Nassau	4, 762	136, 860	62, 182	43, 808	332	7, 516	3, 041		24, 400	2, 573	202	10, 409	4, 907	22, 212	2, 737	503
Orange	13, 166	3, 381, 410	206, 330	90, 025	1, 384	12, 138	8, 531	5, 760	30, 639	1, 116	71	21, 219		75, 785		6, 158
Polk	8, 160	400, 000	56, 000	80, 000	640	7, 140	6, 400	20, 000	39, 280		200	4, 800		66, 400		7, 200
Putnam	13, 718	2, 151, 607	80, 000	146, 759	567	5, 084	4, 260	4, 337	27, 271	5, 132	1, 856	7, 659		29, 091	17, 988	5, 095
Santa Rosa	2, 050	50, 000	24, 380	34, 200	238	3, 012	2, 669	265, 140	10, 500	960		3, 850	8, 947	16, 240		22, 325
Saint John's	2, 880	717, 190	67, 985	86, 368	456	6, 822	3, 833	2, 390	13, 027	445	8	11, 235	240	20, 870		
Sumter	10, 412	474, 024	79, 500	26, 542	1, 022	6, 350	7, 632		45, 330	6, 870	200	9, 550		23, 940		800

Suwannee	32, 735	401, 904	108, 875	239, 891	836	8, 014	6, 144	4, 400	130, 300	12, 384	1, 648	17, 800	10, 090	35, 000	850	....
Taylor	8, 794	87, 102	75, 650	87, 105	333	9, 126	7, 945	46, 860	48, 791	6, 900	474	21, 287	607	22, 889	....	2, 635
Volusia	3, 688	753, 410	88, 945	54, 252	363	8, 370	3, 573	...	1, 876	....	134	5, 935	500	31, 255	8, 010	....
Wakulla	9, 320	121, 106	55, 020	91, 836	89	3, 204	4, 843	47, 539	....	....	....	....	....	18, 780	....	....
Walton	9, 144	126, 976	132, 514	86, 134	417	12, 140	8, 509	112, 983	48, 965	9, 893	388	19, 274	2, 325	27, 945	....	12, 324
Washington	10, 000	160, 000	152, 880	154, 800	660	13, 500	5, 720	32, 000	....	....	....	....	4, 000	23, 600	500	5, 000
Total	863, 515	22, 128, 013	5, 088, 744	8, 129, 801	39, 593	516, 986	297, 198	1, 450, 609	3, 040, 657	306, 766	57, 202	922, 335	89, 028	1, 752, 909	101, 353	210, 357

The product of oranges for the year 1879 is estimated at 45,000,000 (not returned). Lemons, limes, guavas, and pine-apples are quite extensively cultivated.

HARBOR AND CITY OF PENSACOLA.

The Gulf of Mexico is the natural basin for a larger extent of country than any similar sheet of water on the globe, and the finest bay and harbor on its coast is that of Pensacola, on which are located Forts Pickens and Barrancas and the Warrenton navy-yard.

The city of Pensacola, located at the head of the bay, is a most beautiful place, and deserves special mention as the most attractive feature of West Florida. The following description is derived from an official publication of the Commissioner of Immigration:

The city of Pensacola has natural advantages which destine it to become, by rapid strides, the Chicago of the South. It is situated on the north coast of the Gulf of Mexico, in latitude 30° 28′ north and longitude 87° 22′ west of Greenwich, only 10 miles from the open sea. Its thoroughly land-locked harbor covers an area of over 200 square miles, being about 30 miles long and from 5 to 8 miles in width, having unsurpassed anchorage, and a depth of from 30 to 35 feet. The entrance to the harbor is about half a mile wide, with an average depth on the bar of *twenty-four feet.* The same depth is readily secured at the wharfage line in the city. A laden ship of the largest tonnage can approach the city at any time in the year, or leaving its wharf can be in the open sea in an hour and a half.

As a place of residence, Pensacola is attractive by a healthy and genial climate. It has an abundance of excellent pure water, and the regularly changing land and sea breezes make it a pleasant abode at all seasons. Its gardens afford flowers and fruit winter and summer. Most tropical plants grow there, and require but little protection from the cold in winter, whilst all kinds of cereals and northern fruit yield early and abundant crops. The soil of the immediate vicinity is sandy and the drainage perfect.

The lands of the neighboring country are of the character known as swamp, hammock, and pine. The swamp lands are those lying on the Escambia and Perdido Rivers and their tributaries, and are remarkable for their exhaustless fertility, those brought under cultivation yielding heavy crops of corn, cotton, rice, and sugar-cane. The great body of these lands is covered with oak and cypress forests, ready to the hand of the great ship-building interests, which the progress of commerce will speedily foster.

The hammock lands are intermediate between the swamp and pine tracts. They afford the healthiest localities for settlements, and are easily cultivated, yielding abundant returns for the labor bestowed on them.

The pine lands have an exhaustless wealth of the best timber, whilst the herbage of the forest affords permanent pasturage for cattle, which require no shelter and very little care.

All these classes of lands are readily reclaimed for agricultural purposes, whilst the forest will for a century to come supply the growing export trade in timber.

The commerce of Pensacola has hitherto been limited to the export of Florida timber brought down on the rivers and creeks emptying into its magnificent bay. Want of communication has been an impediment to its growth, but the completion, in the winter of 1870, of the Pensacola and Louisville Railroad to its junction with the Mobile and Montgomery Railroad, establishing *a connecting link with the entire railroad system North and West,* must speedily lift Pensacola to the dignity of a first-class commercial city. By this link in the great chain of railroads, Pensacola is brought as near to Chicago as is New York.

The best customers and consumers of the great grain and produce growing West live upon the shores of the Gulf, in the West India Islands, in Central and South America. The Pensacola route of transportation shortens the exchange of commodities between these markets and the teeming West by thousands of miles and by many days, thus effecting a double economy of time and cost of transportation.

A glance at the map will readily demonstrate the fact, so little known heretofore, that the distance from Chicago to Pensacola is only about 900 miles. It will also show that from Pensacola the distance to Tampico is 900 miles; to Havana, 620 miles; to Matamoras, 800 miles; to Vera Cruz, 950 miles; to Hansacula, 950 miles. The last-named place is the eastern port of the Isthmus of Tehuantepec.

No vessel has ever been driven ashore in any storm in the harbor of Pensacola, and no gale has produced a freshet. The rivers emptying into the bay are clear and free from alluvial deposit, and the depth of water on the anchorage ground, as well as on the bar, remains unaltered since the earliest Spanish surveys.

With the railway connection recently established and daily expanding, this magnificent port becomes the most suitable outlet f r the commerce of the entire Mississippi Valley. It has this great advantage over New Orleans, that it is close to the Gulf, and not obstructed in its commerce by a shifting and treacherous bar, causing costly delays to shipping, and often upsetting the fairest calculation for commercial profits. The vast expenditure in towage up and down the river to which the New Orleans shipping is subjected in reaching and leaving that inland port is saved in Pensacola, and it is easy demonstrable that shippers in New Orleans can ship their cargoes more cheaply from the port of Pensacola than from their own levee. Still greater will be this economy when the canals now proposed and under survey shall connect the Mississippi with Mobile Bay, Perdido Bay, and Pensacola Bay, permitting steamers to bring their upland cargoes directly to Pensacola, and lay them alongside the sea-going vessels.

The splendid water-front of the city admits of running railway freight directly down on the wharves, and to load vessels immediately from the cars. The elevated bluffs on this water-front affords facilities for coal depots, from which vessels can be supplied through shutes, thus saving greatly in expense of handling.

Having thus briefly alluded to the physical features of the port, we will now examine the advantages of its relative position to other ports.

Taking Chicago as the initial or starting point, as being equally distant from New York and Pensacola, railroad trains destined to each of the cities would arrive at their destination within the same time. The one arriving at New York would have traveled over 900 miles, and would then be as *far north* as when it started from Chicago, whereas the one arriving at Pensacola would have gone directly south 900 miles, thus saving that number of miles between the initial point (Chicago) and any other point south of Pensacola. This distance, to be balanced by transit to and from New York, is equal to a gain of six days in favor of Pensacola.

Take now the return cargoes, one *via* New York and the other *via* Pensacola, say coffee, &c., from Havana, distant from Pensacola 620 miles. The one by way of Pensacola would have reached its ultimate destination, and have been distributed, before the other could possibly have reached New York. These remarks apply with equal force to all the cities and towns lying along and in connection with this great national artery of intercommunication, trade, and commerce.

The Pensacola and Louisville Railroad line and its connections, unlike those leading to the Atlantic ports, *bisect* the parallels of latitude of the United States; hence it must collect and transmit the productions of these different latitudes, consisting of wheat, flour, corn, pork, bacon, lard, cheese, bagging, rope, iron, lime, coal, and a great variety of industrial products, such as furniture, clothing, machinery, implements, &c., concentrating them all by one line at one single point of shipment, and giving that point the same advantages to be offered to the shipping interests of the world that are now afforded at the said Atlantic ports through a hundred different channels at a vastly increased expense, both in time and money, and enabling ships desiring freights to any part of the world to make such selections as their interests or exigencies may require.

The commerce of the world will hereafter be carried on through the agency of steam, and will expand in the use of that agent just in the ratio in which fuel (coal) can be easily and cheaply obtained for that purpose. The coal-beds of Alabama, estimated to cover between 4,000 and 5,000 square miles of area, are intersected by this line of road, and, from their contiguity to Pensacola, must become the great source of supply for the steam marine and coaling stations of all points south of Pensacola. The coal now used for this purpose is principally brought from Great Britain, a distance of 3,000 miles. From the Alabama coal-beds to Havana (which can be thus supplied) the distance is about 810 miles, and coal from these mines can be placed on shipboard at Pensacola at $4.75 per ton; the sea transportation is but 620 miles. These facts and figures guarantee that the day is not far distant when Pensacola must become the great coal depot of the Gulf, making annual shipment of millions of tons of this article, developing the resources and wealth of the country, and expanding into one of the first cities in the world.

The rapid development of the iron mines of Alabama, whose natural outlet to the markets of the world is the port of Pensacola, will not only contribute a considerable quota to the commerce of this port, but will, in connection with the Florida forests, furnish superior material for ship-building, which at no distant day must rival in extent the similar industry of Northern ports, the proximity and cheapness of all material required, giving builders in this locality peculiar advantages.

FACILITIES FOR TRANSPORTATION.

No State in the Union has so extended a sea-coast as Florida, and none contains a larger extent of inland navigable water; nor is there any State which enjoys greater facilities for permanent, reliable, and cheap communication with the commercial marts of the world and the interior cities of the North and West. Ocean steamers, with the most ample accommodations for passengers and the most extended appointments for freight, ply regularly between New York, Boston, Philadelphia, Baltimore, Charleston, and Savannah, and the Florida Atlantic ports. At Fernandina these lines connect with the Gulf and West India Transit Railway, which, at Hart's Road, connects with the Jacksonville and Fernandina Railway; at Callahan intersects the Savannah and Jacksonville Railway; at Baldwin with the Florida Central Railway; at Waldo connects with the Peninsular Railway to Ocala, and with the Santa Fé Canal to Santa Fé Lake; at Gainesville with the Florida Southern Railway to Palatka and Ocala; and at Cedar Keys with lines of steamers to Tampa, Key West, Havana, New Orleans, and all the Gulf ports.

At Jacksonville connections are made with the numerous steamers on the Saint John's and Oclawaha Rivers, which connect at Tocoi with the Saint John's Railway to Saint Augustine; at Palatka with the Florida Southern Railway to Gainesville and Ocala; at Astor with the Saint John's and Lake Eustis Railway; at Sanford with the South Florida Railway to Lake Apopka and the Kissimmee River; at Salt Lake with the Saint John's and Indian River Tramway to Titusville; and at Lake Poinsett with lines of stages to the Indian River at Rock Ledge.

At Jacksonville connections are also made with the Fernandina and Jacksonville Railway; with the Savannah and Florida Railway, which tersects the Gulf and West India Transit Railway at Callahan; with e Florida Central Railway, which intersects the Gulf and West India ansit at Baldwin; connects at Lake City with the Jacksonville, Pen-cola and Mobile Railway, which, at Ellaville, intersects the Suwannee ver, which is navigable for steamers to Cedar Keys; at Live Oak con-ects with the Savannah, Florida and Western Railway; at Tallahassee ith the Railway at the Gulf at Saint Mark's; and at Chattahoochee ith the Atlantic and Western Railway, now in process of construction Mobile, and with lines of steamers to Apalachicola, Eufaula, Ala., d Columbus, Ga. All rail routes, with close connections and through arlor and sleeping cars for passengers and fast freight lines, with ven-lated cars for fruit and vegetables, connect Florida with Montgomery, Atlanta, Louisville, Cincinnati, Saint Louis, and Chicago, in the West; Savannah, Charleston, Richmond, Washington, Baltimore, Philadelphia, New York, and Boston, in the North, thus affording the largest facilities for rapid transit with the numerous competing lines, and the ocean steamers prevent exorbitant charges.

The completion of the lines of railway now under construction will render all portions of the State immediately accessible. The State authorities have granted about 16,000,000 of acres of her swamp lands in aid of works of internal improvements, thus giving a powerful impetus to these enterprises, while Northern capital is pushing them to rapid completion.

No less than five lines of railway are now in progress in East Florida, running south, with the view of reaching Tampa Bay, Charlotte Harbor, Indian River, and Key West.

1st. The Tropical Railway, an extension of the Peninsular, is progressing rapidly from Ocala southward, with its iron purchased, and more than a thousand hands at work.

2d. The Florida Southern, from Palatka to Gainesville, is pushing south also from Ocala to the eastward of the Peninsula.

3d. The South Florida, from Sanford, is extending southward still farther to the east.

4th. The Live Oak, Rowlands Bluff and Charlotte Harbor Railway is backed by a powerful company.

5th. The Jacksonville, Saint Augustine and Halifax River Railway is under construction, from Jacksonville to Saint Augustine, with a view to an ultimate extension down the coast to the Indian River.

The Atlantic and Western Railway, an extension of the Jacksonville, Pensacola and Mobile Railway, from Chattahoochee to Pensacola, is under contract and being rapidly constructed, with a view to immediate completion.

A large portion of the route of the Jacksonville, Tampa and Key West Railway has been surveyed, and no doubt exists of the early commencement of that important enterprise.

Those in process of construction, and others projected, with the system of canals connecting the lower Saint John's with North Halifax and Indian Rivers, and the Upper Saint John's with the Kissimmee, Lake Okeechobee, and Caloosahatchee, when all completed, will give Florida the most complete system of internal communication of any Southern State, and render her one of the wealthiest and most desirable for residence and cultivation.

FISHERIES.

The extent and wealth of the fisheries of Florida are, beyond comparison, greater than any other State of the Union. Her twelve hundred miles of sea-coast from Fernandina to Key West, and round to Cedar Keys and Pensacola, with the extensive bays and harbors, abound in turtle, oysters, and sponge, while the waters teem with fish in the greatest variety.

It has been remarked by an experienced observer that a fee-simple to three miles wide of her coast line of waters was more valuable than the same amount of land adjacent. The annual exportation of oysters. fish, and sponge amounts to hundreds of thousands of dollars. Hundreds of families in Florida, Georgia, and Alabama annually resort to the seacoast and gather a supply of fish, with which they return home.

State legislation has, as yet, furnished no adequate protection for these fisheries, and they are annually used by fishermen from other States, "without money and without price," and the State derives no revenue.

The inland waters, too—the rivers, creeks, innumerable lakes and ponds—all abound in the varieties of fresh-water fish, which are gathered without let or hinderance for food and enriching the soil, while the supply seems inexhaustible. With proper care and protection against waste and destruction, the supply would last for generations before it became necessary to resort to artificial cultivation.

STOCK GROWING.

Cattle raising has long been one of the most lucrative branches of business in Florida. In large portions of the State, notably in the southern, the growing of crops has been neglected for the all-absorbing business of cattle raising, which is attended with no expense, save the personal supervision of the herds, and in gathering the stock for marking and for market. The cattle range on the public domain through the year, and the plains, savannas, and swamps of South Florida have afforded pasturage for innumerable herds, from which, during the civil war, the Southern army drew large supplies, and from which the markets of Key West and Cuba derive their present supply. It is not uncommon to find men owning thousands of head of cattle without the proprietorship of lands, and many of the herdsmen count their stock by tens of thousands. The profits are fabulous, as the cost of keeping the cattle is only the expenditure for herding and marking, no food being required other than the natural supply. The annual burning of the grass, which has long prevailed in the winter, has seriously impoverished the soil and reduced the quantity of grass, so that the native stock of later grass has become dwarfed and inferior. As population increases, and the lands become absorbed by settlers, the stock range becomes more restricted, improved methods are being adopted, and improved stock introduced. No State offers greater inducements for stock growing, either upon the wild method heretofore existing, or upon the system of thorough cultivation and high breeding. The facilities for cultivating green forage crops during the winter, when the grasses become tough and innutritious, afford great advantages over those sections of the country where cattle must be housed and fed for from one-third to one-half the year.

The raising of sheep and growing of wool is also a most profitable industry, as sheep thrive through the year on the natural pasturage, and require no care except herding and protection from vagrant dogs, of which there is too great a number. With no legal protection against these depredators the business, when it has been prosecuted as a reliance, has yielded from 33 to 90 per cent. per annum profits. It can be seen at a glance, that with an annual increase very largely greater than in the cold States, and no expense for feed, and entire exemption from the cold northers which sweep off whole flocks in the West, the profits must be very great and the industry so remunerative as to induce a rapid extension of the business.

Hogs are raised more cheaply and easily here than in the colder climates. They do well "on the range," as in the winter there is a large supply of acorns, and in the swamps and hammocks of roots and native products. There is no reason why pork should not be raised in sufficient quantity to supply the home market at least, although the want of frost, or freezing weather, is not conducive to profitable packing for export.

Bee-keeping is rapidly engaging attention, and will soon become a source of large State wealth and individual revenue.

THE TREES OF FLORIDA.

Dr. A. W. Chapman, of Apalachicola, author of the Flora of the Southern States, in 1875 made a journey along the western coast, for the purpose of obtaining specimens of trees for the Centennial Exhibition. He made a thorough exploration from Anclote Keys to Cape Sable, and ascended the Caloosahatchee. The following is the list of trees obtained, as given in his report:

> The number collected exceeds your estimate by ten species, and falls short of my own by the same number. I believe I obtained all the native trees known down there, except *Simaruba*, and perhaps *Calyptranthus*, if it is a tree. I found several trees which I supposed to be shrubs, and *vice versa*. I made a thorough exploration of the whole western coast, from Anclote Keys to Cape Sable, wherever we could find smooth water for safe anchorage. At Charlotte Harbor I diverged from the coast and ascended

Caloosahatchee River, in order to get such woods as do not grow in the influence of salt air. This was really the most interesting part of the route. Gigantic Acrostichums, 10 feet high, covering acres, Epiphtyes loading the trees, and the entire vegetation tropical. A peculiarity of these tropical trees is that for miles they occur to you as mere shrubs, when at some other locality you find them lofty trees. I was much disappointed in the size of most of the forest growth in that region. On the Keys you can scarcely anywhere find a large (or rather, a tall) tree. Some of these were large enough at the base, but we generally found such hollow, and of some we never did find a sound one. You will be disappointed, as I was, to find the growth so small. I do not remember to have seen a tree, during the trip, 2 feet in diameter, with the exception of the Live Oak, and on the Keys none of them get to be more than 30 or 40 feet high. The Mahogany is not found in Florida, and should be erased from the Flora. My authority for introducing it was a pod picked up on the beach by Dr. Leitner.

Hibiscus tiliaceus was not seen by me, and I think Dr. Blodgett must have got it from cultivation. In Jamaica it is a shrub 12 to 15 feet high. *Terminalia* is not a native, and is, I believe, local along the Saint John's or near Saint Augustine. The others mentioned I did not meet with on any of the Keys I visited. Whether they become trees I cannot say, for I forget the sources of my information regarding them when writing my book. It was of course impossible to visit all the hundreds of Keys along the reefs, and it is probable that these omissions may occur on more westwardly ones than those I visted.

The following is a modified arrangement of Dr. Chapman's list of Florida trees:

Anona (Custard Apple).—No flowers or fruit; 15 to 20 feet high. The fruit is said to be egg-shaped, 1½ inches in diameter, and eatable when fully ripe.

Capparis Jamacencis (Caper-tree).—A low tree.

Canella alba.

Guaiacum sanctum (Lignum Vitæ).—Only found, if I am rightly informed, on the Lignum Vitæ Keys, and quite rare there.

Xanthoxylum Pterota, 12 to 20 feet high.

Bursera gummifera (Gumbo Limbo, Gummer Limmer).—The largest of South Florida trees, abounding in gum.

Amyris Floridiana (Torch-wood).—Mostly shrubby.

Xymenia Americana (Hog Plum).—2 to 20 feet high.

Schaefferia frutiscens (Crab-wood).—A small tree.

Sapindus (White-wood).—This is scarcely the tree of the Southern States and of my Flora; I suspect it is *S. saponaria.*

Hypelate paniculata (Maderia-wood).—This wood is very like Mahogany, and is highly valued. It is not abundant, and was only found on Metacumba Keys.

Rhus metopium, 20 to 30 feet high. It is very poisonous, and we all got peppered by it.

Piscidia erythrina (Dog-wood).—A rather large tree.

Pithecolobium unguis-cati.—Rarely a small tree.

Rhizophora mangle (Red Mangrove).—Commonly a low spreading tree. On the Thousand Islands it attains its largest size—40 to 60 feet. All the low Keys are formed by this tree.

Conocarpus erecta (White Buttonwood.)—It comprises almost the only fuel used in Southern Florida, and extends north as far as Anclote Keys.

Luguncularia racemosa (Black Buttonwood).—A small tree everywhere, or a mere shrub, except among the Thousand Islands and north of Cape Sable, where it forms a large tree.

Eugenia buxifolia (Iron-wood).—25 to 30 feet high.

Eugenia Monticola.—South Florida; about 30 feet high.

Eugenia (———).

Eugenia (———), near *dichotoma*, but probably distinct. This was only seen at Caximbus Bay, and was called "naked-wood."

Eugenia (Stopper-wood).—A small tree, in fruit.

Guettarda Blodgetti.—Mostly a shrub.

Randia clusiæfolia (Seven-years' Apple).—With flowers and fruit.

Sideroxylon pallidum (Mastic).—A middle-sized tree.

Sideroxylon pallidum, var. *sphærocarpum*.—A small tree.

Sideroxylon.—A large tree.

Chrysophyllum microophyllum.—6 to 20 feet high.

Mimusops Sieberi.—A large tree. We found the trunk invariably hollow.

Bumelia parvifolia.—A shrub or small tree.

Jaquinia armillaris.—A rather small tree with most curiously grained wood.

Myrsine Floridana.—Mostly a shrub; rarely a small tree.

Ardisia Pickeringii.—Mostly a shrub, but on the Keys a small tree.

Citharexylon villosum (Fiddle-wood).—Rarely a small tree.

Avicenna oblongifolia (Black Mangrove).—Only a tree among the Thousand Islands.

Avicennia tomentosa (Black Mangrove).—At Cedar Keys only.

Pisonia obtusata.—With male flowers.

Coccoloba Floridana.—20 to 30 feet high. In fruit.

Coccoloba ubifera (Sea-side Grape).—In fruit.

Persea Catesbaei.—No flowers or fruit.

Drypetes crocea.—A small tree.

Ficus aurea (Wild Fig).—A large tree full of milky juice. It is also called gum-tree, and the juice forms a kind of India rubber.

Ficus.—Perhaps the same as the preceding.

——— (Silver Palmetto or Silver Cabbage Tree).—The berries are white, but in the absence of flowers the genus is doubtful. It attains a height of 30 to 40 feet. It occurs first at Cape Romano, and is found sparingly on the mainland southward. It is more common on the Keys, but I never heard of it before.

Yucca aloifolia. I found this from Manatee southward, 15 to 25 feet high.

Pinus clausa, *N. sp.*—At Apalachicola. Dr. Engelmann is doubtful. Perhaps it may be a variety of *P. inops*.

ORANGE STATISTICS OF FLORIDA.

Judge A. A. Knight, the supervisor of the Tenth Census for the State of Florida, was, in addition to his other duties, intrusted with the task of ascertaining the number of bearing orange trees in the State, and their production for the year 1881. He has kindly permitted me to take the following figures from the papers in his office. Twenty-five thousand circulars were issued, which elicited about 70 per cent. of replies. Twenty-five of the thirty-nine counties in the State are embraced in the report, fourteen failing to return replies. The deficiency in this direction is conterbalanced by the supplement which closes the report. It is expected that the yield of fruit will very rapidly increase from this time forward, both from the large number of new groves coming into bearing with each succeeding year, and the increased productiveness of the older trees.

REPORT.

Counties.	Number of bearing trees.	Yield in 1881.	Value.
		Number.	
Alachua	13, 111	2, 250, 000	$33, 750 00
Baker	21	9, 450	141 75
Bradford	3, 377	338, 850	4, 815 50
Brevard	10, 884	1, 250, 000	18, 750 00
Calhoun	841	282, 400	4, 170 50
Clay	738	165, 700	2, 522 25
Columbia	436	157, 850	2, 741 00
Dade	500	500, 000	7, 500 00
Duval	10, 131	3, 000, 000	45, 000 00
Escambia	No report		
Franklin	do		
Gadsden	do		
Hamilton	do		
Hernando	7, 685	2, 500, 000	37, 500 00
Hillsborough	18, 683	4, 409, 150	45, 410 25
Holmes	No report		
Jackson	do		
Jefferson	do		
La Fayette	1, 157	43, 800	662 00
Leon	No report		
Levy	1, 460	500, 000	7, 500 00
Liberty	No report		
Madison	594	512, 900	7, 665 00
Manatee	17, 291	2, 000, 000	30, 000 00
Marion	46, 195	6, 000, 000	90, 000 00
Monroe	500	500, 000	7, 500 00
Nassau	No report		
Orange	29, 049	4, 000, 000	30, 000 00
Polk	2, 283	1, 500, 000	22, 500 00
Putnam	64, 170	7, 120, 631	108, 414 30
Santa Rosa	No report		
Saint John's	12, 006	2, 000, 000	30, 000 00
Sumter	13, 029	2, 250, 000	33, 750 00
Suwannee	157	120, 700	2, 000 00
Taylor	1, 846	255, 200	2, 747 50
Volusia	24, 638	4, 000, 000	60, 000 00
Wakulla	No report		
Walton	do		
Washington	do		
Supplement	11, 536	451, 225	7, 056 10
Total	292, 324	46, 097, 856	672, 176 65

Respectfully submitted.

GEORGE B. CARSE.

FLORIDA: ITS SOIL, RESOURCES, AND MEANS OF TRANSPORTATION.

For reliable information in regard to all points of agricultural interest I must confine myself in this report to the counties of Nassau, Duval, Clay, Saint John's, Volusia, Orange, Marion, Brevard, and Putnam.

NASSAU COUNTY.

This county contains an area of 600 square miles, and has but about 4,000 acres under cultivation owing to the fact that much of the land is "pine barrens" and "flat-wood" country, of but little value to agriculturists. Scattered along the river is some land which produces grazing for cattle, a limited amount of long-staple cotton, corn, potatoes, and peaches. Here fertilizers are necessary, and winter vegetables are liable to be nipped by the frost; still, the annual yield of farm products reaches the value of $50,000, consisting chiefly of cattle, swine, poultry, corn, potatoes, and peaches.

This county is well supplied with railroads, and may have a prosperous future, should its people, the great majority of whom were once slaves, ever attain to that state of intelligence indispensable to agricultural success. Fernandina, the county seat, has a fine harbor and quite a lumber trade.

This county cannot be recommended for the raising of oranges or of the semi-tropical fruits, but may be reasonably successful with the ordinary farm crops.

DUVAL COUNTY.

With an area of 860 square miles this county has only about 5,000 acres of land under cultivation. While the greater part of the soil is light and sandy, there are some tracts of rich "hammock" which may be utilized for the cultivation of rice, corn, potatoes, cane, and cotton; but it is to much exposed to the cold northwest winds for the successful raising of oranges or of the semi-tropical fruits, with the exception of that portion east of the Saint John's River. Here, as elsewhere in this State, the eastern shore of the Saint John's is much better protected from the cold than the western banks, owing to the fact that the cold northwest winds are considerably warmed in passing over this wide expanse of water. Although the county is much frequented by invalids, the climate is not conducive to the health of those suffering from pulmonary or bronchial diseases, as the changes in temperature are very sudden and severe, ice being frequently formed near the mouth of the river, immediately followed by very hot weather. The annual farm productions are valued at about $50,000, consisting principally of cattle, milk, butter, swine, poultry, rice, cotton, potatoes, and molasses. The means of transportation in this county are ample, both by rail and by water, the rates here, as elsewhere in this State, averaging about five cents per mile by rail, and three cents per mile by steamer. Jacksonville, with its numerous hotels, furnishes a good market for garden farmers. Land in the city commands very high prices, building lots being frequently sold at the rate of several thousands of dollars per acre. Skilled farmers, with the aid of fertilizers, can do well in some parts of this county.

CLAY COUNTY.

With an area of 425 square miles, Clay County has about 4,000 acres of land under cultivation, and raises farm productions to the value of about $64,000 yearly, including some cotton and sugar. There are several fine lakes in this county, containing many excellent food-fish: but lands must be selected here with great care to avoid malarious districts, and it should not be recommended for raising fruit of the Citrus family, though many trees are being set out near Green Cove Springs, the county seat, which may succeed in sheltered places protected by heavily-timbered pine lands. There is considerable yellow-pine timber in this region, with some rich hammock lands, well adapted to the production of the ordinary farm crops. No railroad is found in the county, and it has but a small population, with no large towns. There are several hotels at the county seat, but those afflicted with pulmonary or bronchial difficulties should go farther back among the pines, away from the chilling, damp night air of the Saint John's.

SAINT JOHN'S COUNTY.

This county contains 970 square miles, and has but about 3,000 acres under cultivation, owing to the fact that it is mostly a "flat pine-woods and palmetto-scrub country," with but little rich hammock land. Its location, however, between the Saint John's River and the Atlantic renders it more exempt from frost and better adapted to fruit culture than more interior counties in the same latitude. Colonel Hart's famous orange groves are located in this county, opposite Palatka, and demonstrate the fact that with skillful cultivation and the aid of fertilizers excellent oranges can be raised here. The farm productions amount to over $90,000 per annum, including considerable rice, sugar, cotton, potatoes, and corn. Here skilled labor, backed by energy and sufficient ready money to tide the settler over for a few years, will in due time reap its reward; but the impecunious and the ignorant will find no bonanza in Florida. This county has but one railroad, that connecting Saint Augustine with the Saint John's at Tocoi, fourteen miles in length, over which the fare is $2.

MARION COUNTY.

Comprising an area of 1,000 square miles, and having nearly 50,000 acres under cultivation, this county contains some of the richest and most elevated land in in the State. The high hammock lands are extensive and very productive, but much better adapted to the raising of vegetables than to the development of healthy men, and much care must be taken in locating dwellings, or, as in the West, fever and ague will take off all the profits for the benefit of the doctor. Although there are some flourishing groves in sheltered places near Ocala, oranges there are liable to suffer from frosts, and the extreme eastern and southern portions of the county are better suited to the culture of the Citrus family of fruits. Farm productions are raised in this county to the value of $300,000 yearly, including principally corn, potatoes, rice, molasses, and poultry. Lands near transportation are held at high figures, and there is but little government land to be obtained.

Two railroads run through this county, and the means of transportation will soon be exceptionally good *via* these roads and the Ocklawaha River, which is navigated by two lines of steamers from Silver Springs to and over the Saint John's. There are some beautiful lakes in this county, the eastern shores of which are well adapted to orange culture, being thus protected from the cold northwest winds. Considerable game is found in the heavy-timbered tracts, and food-fish abound in the lakes and rivers. The Florida Southern Railroad, owned by Boston capitalists, is developing an extensive and profitable lumber trade along its line, and many of the settlers build houses, barns, and fences with the beautiful yellow pine, green from the saw-mill. Industrious settlers who can afford, to wait until the acidity of the soil is removed by cultivation will succeed here, provided they can secure good land at reasonable prices. No injurious acids are found in the hard-wood lands, but unless great care is taken the farmer will suffer from chills during the first year's cultivation.

BREVARD COUNTY.

Containing an area of 4,000 square miles, this county has but 2,000 acres under cultivation. Much of this county is composed of "flat lands," often overflowed and not easily drained, with a stiff-clay subsoil, through which the tap-root of the orange tree cannot penetrate to water; consequently the Citrus family of fruits will not thrive in the greater part of this region. Along the banks of the Indian River, however, excellent oranges and semi-tropical fruits are raised; but the land in this county adapted to such culture is limited in extent, and is held at high prices. Oysters, fish, and game abound in some localities, and much good grazing land is found; but malaria must be carefully guarded against, and there is but comparatively little land in the county adapted to the wants of people from the North for a permanent residence. Yearly farm productions are valued at about $47,000, including principally cattle, swine, rice, and potatoes. The South Florida Railroad extends 40 miles from Sanford, on Lake Monro, Orange County, to Lake Kissimee, Brevard County. Titusville, the county seat, is reached by a long steamboat ride from Lake Monro to Rock Ledge, and thence by carriage. Drainage may open large tracts of rich lands to the settler; but until then this region is more attractive to the sportsman than to the agriculturist.

VOLUSIA COUNTY.

This county contains 1,800 square miles, and has but 4,000 acres under cultivation. The eastern portion along the Halifax River comprises some rich hammock lands, which in years past have produced great quantities of sugar, and with good cultivation may again yield much cane. West of this belt is a vast prairie, interspersed with pine and cabbage palmetto, affording excellent pasturage to large herds of cattle during the entire year. On the extreme west, extending from the northern end of the county south about 30 miles, is a rolling pine country, on which are hundreds of young orange groves; from this southward is a rolling pine scrub until the Saint John's is reached, with its varying banks of hammock and savanna.

With much care to avoid miasmatic swamps, and the chills which arise from newly-plowed rich hammock lands, desirable farms may be found in this region, which, when cleared and dispossessed of their acidity by cultivation, will produce semi-tropical fruits and vegetables in abundance. At present the yearly farm productions are valued at $60,000, including principally cattle, poultry, cotton, molasses, and potatoes. The present yield of lumber is one and one-half millions of feet per annum, which can be increased almost indefinitely.

Transportation is confined to steamers on the Saint John's River, but several railroads are chartered. Enterprise, the county seat, has demonstrated the important fact that oranges and vegetables can be raised at a profit by skilled laborers, with the aid of fertilizers, the most popular of which is that made by George B. Forrester, of New York.

ORANGE COUNTY.

Orange County, comprising 2,300 square miles, and having 14,000 acres under cultivation, is generall rolling pine land, interspersed with large lakes, rich hammocks, and comparatively worthless flat pine lands, all more or less heavily timbered. Stock-raising has been the predominant industry until recently, with cotton, corn, and cane; but now fruit culture is absorbing general attention, and the orange, lemon, lime, guava, pine-apple, and banana are cultivated to considerable extent. The South Florida Railroad runs from Sanford southerly through the county, which, with a short road from Astor, on the Saint John's, to Lake Eustis, together with the numerous Saint John's steamers, furnish exceptionally good facilities for transportation. The more desirable lands near the towns are held at high prices; but still, by using much care to avoid unhealthful localities industrious and skillful agriculturists may obtain good homes. Successful ice manufactories have been established, and by using cistern water many Northerners live here all the year in tolerable comfort. The yearly farm productions, consisting chiefly of cattle, poultry, rice, corn, potatoes, molasses, and honey, are valued at $100,000, and many fine orange and lemon groves may be seen about Sanford, Orlando, Bellaire, and Altamont.

PUTNAM COUNTY.

Comprising over 800 square miles, with 1,500 acres under cultivation, this is in many respects the most desirable and flourishing county in the State. The numerous lines of steamers on the Saint Johns' together with the South Florida Railroad, afford facilities for transportation unexcelled in the State. Many beautiful lakes are found in this region, fully stocked with excellent food fish, and game in many parts is abundant. The portion of the county lying east of the Saint John's is appropriately called the "Fruit-land Peninsula," and is very fertile, containing also celebrated sulphur and medicinal springs, which are much frequented by the sick from all the adjacent region. The county contains a great variety of soil, high and low hammock, high rolling pine land, much of which is heavily timbered with hickory, oak, and yellow pine. Many of the finest orange groves in the State are found here, and more than 5,000 acres are devoted to the cultivation of the orange alone, while cotton-rice, sugar, corn, sweet potatoes, and all the semi-tropical fruits form a permanent reliance for agricultural industry. Palatka, the county seat, is a very flourishing city, connected by rail and telegraph with all parts of the State which have railroad communications. San Mateo and Crescent City are flourishing towns, and the county is rapidly filling up with a good class of people from the Northern and Western States. The yearly farm productions amount to nearly $200,000, comprising principally cattle, butter, milk, swine, poultry, rice, grain, cotton, sugar, sweet potatoes, and honey.

GENERAL OBSERVATIONS.

This completes the list of localities visited by me, and they are in many respects the best counties in the State.

Except near the sea-coast marshes, mosquitoes are not very troublesome, and the noxious insects and reptiles avoid the settlements and generally confine themselves to the overflowed lands and swamps.

While much of the soil in this State is practically worthless in its present state, there are large tracts in the aggregate which are rendered very productive by the peculiar character of the climate and by the subterranean waters to which the roots of the trees find access, thereby causing the trees of the Citrus family to flourish even during protracted droughts which in the North would destroy every living thing.

There is a great demand for a government experiment station in Florida, which would be of incalculable service in showing the people what can be raised here and the best methods of culture.

The tea plants sent to this State by the Department of Agriculture have not received proper care; but the few that have survived the neglect demonstrate the fact that tea can be grown here successfully by intelligent culture.

It is believed by thoughtful men that many tropical products can be raised here in sufficient quantity to save to the nation many millions of dollars annually which are now sent to foreign countries. I refer especially to tea, coffee, sugar, silk, and the many articles of commerce now imported from the Indies, China, and Japan.

Colored laborers are hired here at wages averaging about $1 per day, without board.

Orange trees four years from the seed and one year from the bud will bear fruit in from three to four years.

Orange trees can be bought at prices ranging from twenty-five to seventy-five cents each, and they should be set out during the months of November, December, or January.

Lemon trees bear fruit in four years from the setting.

Bananas are produced in eighteen months from the setting, and ripen from June to December.

The transportation of a box of oranges from Sanford to New York costs about 45 cents.

It is a curious fact that while oranges begin to ripen in October, they may be left upon the tree without material deterioration for twelve months after they are ready for use.

Hoping this report may be of service to the most important of all our government departments, as well as to the interests of agriculture at large,

I remain yours, very truly,

JAMES H. FOSS.

PROCEEDINGS

OF A

CONVENTION OF AGRICULTURISTS,

HELD IN THE

DEPARTMENT OF AGRICULTURE,

[Report #22]

JANUARY 10th to 18th.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1882.

CONVENTION OF AGRICULTURISTS.

In July last the Commissioner of Agriculture forwarded the following letter to a large number of agriculturists throughout the country:

UNITED STATES DEPARTMENT OF AGRICULTURE,
Washington, D. C., July 26, 1881.

SIR: It is my purpose to call together in convention, to be held in this Department during the coming winter, such representations of the various branches of agriculture in this country as the leading agricultural associations may select as their delegates.

I wish to meet those who are interested in and skilled in the breeding, feeding, and sale of cattle; those interested in and skilled in the production of the cereal crops of the country; those interested in and skilled in grape culture and the manufacture of wines; those having charge of the agricultural colleges, agricultural societies, and the educational agricultural institutions of the country, for the purpose of discussing the general welfare of agriculture and the various divisions of the industry to which I have alluded.

I shall feel under great obligations to your association if, at any meeting held this autumn, it will choose delegates to these conventions who are qualified to take part in the proposed deliberations.

The first of this series of conventions will be held on January 10th, and will be devoted to the colleges and agricultural societies for the discussion of the general principles of farming and of those questions which belong to agricultural education and the organization of schools, colleges, and associations, and will continue two days.

The second of the series will meet on the 12th day of January, and will be devoted to the discussion of the animal industries of the country, and the various modes of breeding, feeding, and dealing in horses, cattle, sheep, and swine. This convention will continue two days.

The third of the series will be devoted to a discussion of all matters relating to the cereal crops, and will commence on the 14th day of January, and continue two days.

The fourth of the series will commence on the 17th day of February, and will be devoted to the discussion of the management of the vineyards and the manufacture of wines, and will continue two days.

I would request your association to choose delegates to as many of these conventions as are of interest to your section of the country, and as will find representatives within the limits of your society.

Each convention will be composed of three delegates from each of the societies and colleges invited to be present—that is, three delegates to represent the colleges and associations, three delegates to represent those interested in the animal industries as above enumerated, three delegates to represent those interested in matters relating to cereal crops, and three delegates to represent those interested in the subject of the management of vineyards and the manufacture of wine.

Will you be kind enough to designate some person of your society who will be willing to read a paper before the convention which he is elected to attend, and notify me of your selection? Please send to this Department a list of the delegates as soon as they are chosen.

Very respectfully,

GEO. B. LORING,
Commissioner of Agriculture.

In compliance with the request and invitation contained in the foregoing circular letter, a large number of those interested in agriculture and kindred subjects assembled in the library room of the Department of Agriculture on the 10th day of January, 1882. At 11.05 a. m., of that day, the convention was called to order by Dr. GEORGE B. LORING, Commissioner of Agriculture, who said:

The convention will come to order. We all know that there is nothing so important in agricultural investigation in a country like ours as proper comparison and careful conference with regard to the important questions that come before the farming community. We have a large surface extending over many latitudes, every variety of soil, and nearly every variety of production, from the northern latitudes down almost to the tropics; and it is absolutely necessary that a national convention of agriculturists should be composed of those who are interested in all the diverse agricultural interests that cover so much space and are inclosed in such a variety of climate.

I have thought it best, therefore, to divide this assembly into conventions among various branches of our agricultural industry. The first convention, which meets this morning, will be devoted to the discussion of agricultural education and the organization and purposes of agricultural societies, which I consider to be fully as important to the agricultural educational system of the country, in a practical way, as the colleges are in a scientific way. I have always been especially desirous that the practical and scientific in the agriculture of this country should go hand in hand. I know the value of scientific investigation as well as any man possibly can, and set as high a value upon it. I know perfectly well how the several branches of agriculture, with all their economies, have been systematized by the aid of scientists; and I am especially desirous that the same methods that have been adopted with so much success in other countries shall be adopted here. I desire that everything that can be done to increase our crops and economize our modes of living shall be done. And to this end this department will tender every encouragement as long as I have control of its affairs.

The value of practical information cannot be too highly estimated. It is the practical men who have been the pioneers in this great industry. They have leveled our forests, built our towns and villages, and it is through their demands that agricultural machinery has been brought in this country to that degree of perfection which is of so much value to the farmer and the source of such infinite admiration to every observer. There are nowhere in the world finer exhibitions of agricultural machinery than can be found at our annual fairs, brought there, acre by acre, upon the demand of the successful farmers of every section of this country. It is the practical men who have brought this about. It is they who, led by Mr. Johnston, of New York, have instituted "thorough drainage." It is they who have introduced the best breeds of cattle, and have increased, by the introduction of animals adapted to our latitudes, the wealth of this republic to an extent which the Superintendent of the Census informs me is almost incalculable. Now, the work that the scientists and that which the practical men have done should go hand in hand, and I have endeavored to combine both sides of this agricultural investigation in such a way that its result shall be felt not only by colleges and schools, but also on the farms themselves. I thought that it would be well, therefore, to divide the work. The convention that follows this will be devoted to the animal industries of the country—horses, cattle, sheep, swine—during two days. Two days will then be devoted to the cereals—the best kinds of wheat, corn, oats, barley, &c., and to the discussion of methods relative to the management of these crops.

Following that will come the discussion of what is named in the circular as grape-growing and wine-making, including, however, horticulture of all descriptions; one of the most important branches that you can discuss, embracing the careful cultivation of new plants, methods, and processes, and of ornamental and useful trees. I desire especially that the debate should be confined within the limits indicated by the call, but I trust also they will be so extended as to include all valuable information upon the various points under discussion. The benefit which may arise from these conventions must be manifest. I think it was in 1872 that I was first called here to attend a convention similar to this, although not organized in a similar way, the result of which was, I think, a great stimulus to the agricultural industry and ambition of the country. It is now nearly ten years since that was held, but in that time the increase of the agricultural wealth of this country has been enormous. The agricultural machinery of that day was by no means as perfect as it is now. The reapers and mowers of that time did not reach the state of high finish of the present. The introduction of economical fertilizers has been vastly increased, and man has learned that in many instances he has under his own hands almost many natural fertilizers which he can use profitably if he will only apply them scientifically. We now know how to apply muck, clay, marl, all the various natural products lying within our own reach, economically and profitably.

The surprising growth of agriculture during this time has attracted great attention throughout the world. Ten years ago our crop of wheat was about 250,000,000 bushels; now it is more than 450,000,000 bushels. The crop of corn was then about 700,000,000 bushels. In 1880 it was 1,750,000,000 bushels.. The crop of oats was about 230,000,000 in 1870. Year before last it was more than 450,000,000 bushels. Barley has doubled; rye has doubled; the whole grass crop has doubled. The great dairy industry of the Northwest has developed in the past ten years to an unparalleled extent. Now, the reason for this incalculable growth is that every man is engaged in his own industry, for his own good, responsible to his country and to the society in which he lives, and stimulated to the laudable ambition of making himself a good farmer and a good citizen. Within this decade the attention of one section of this country has been earnestly and anxiously turned to the best methods for developing its agricultural industry; and the result of this investigation and thought is that the successful, painstaking farmer there has determined not to confine himself to one crop alone, but to diversify his crops and products, so that not a month shall be lost in conducting his business, nor an opportunity be lost by which he can become a prosperous American agriculturist.

All that I have hastily outlined, and more, has been done since the convention assembled in this room ten years ago. I had the honor to preside on that occasion. I have not seen the opening address I delivered since that time, but I desire to say that I stand now exactly where I did then, when I declared that I was in favor of agricultural education, and agricultural colleges, and agricultural work; and when I maintained that if the schools were brought into close connection with a department of agriculture they would soon secure the respect and support of every intelligent man in this land [applause], as, I am happy to say, they have done. I am ready to join you in all intelligent endeavors for the purposes to which I have alluded, and I am more than grateful to the gentlemen who have assembled here this morning for the interest they have manifested in the call I have issued; and it is for you to see that your deliberations shall be so conducted as to have a permanent and useful influence upon the agriculture of this country.

In conclusion, I have one or two suggestions to make with regard to the organization of the convention. It seems hardly necessary for us to go through all the details of a temporary organization, and I think it best that some gentleman should move the appointment at once of two committees. The first a committee of two or three on credentials, and the second a committee on permanent organization. I would suggest that the presiding officer for each one of the four conventions be chosen, that the burden of six or eight days may not be thrown upon one person. Those representing the agricultural colleges may select their chairman for the two days; those representing the animal interests, their chairman for two days, and so on. I merely lay this before you as a suggestion. I will now request my secretary to call the roll of States.

The roll of States was then called, and the following gentlemen responded:

California.—Hon. C. P. Berry.
Connecticut.—Prof. W. O. Atwater, T. S. Gold.
Colorado.—A. E. Blount.
District of Columbia.—W. S. Birkheimer.
Georgia.—Hon. George R. Black.
Illinois.—Profs. H. Peabody, George E. Morrow.
Indian Territory.—Allen Wright.
Kansas.—George F. Fairchild.
Maine.—Prof. M. C. Fernald.
Maryland.—Hon. J. Carroll Walsh, Allen Dodge, William H. Parker.
Massachusetts.—Prof. William Saunders, Prof. C. V. Riley, John Saul.
Minnesota.—Prof. E. D. Parker.
Mississippi.—Isaac A. Hedges.
Missouri.—Prof. P. Schwitzer.
New Jersey.—Prof. George H. Cook.
New York.—Prof. G. C. Caldwell, Prof. J. P. Roberts.
North Carolina.—Prof. Jos. A. Holmes.
Oregon.—Hon. M. C. George.
Virginia.—Professor Page, Professor Buchanan, Dr. M. G. Elzey, Daniel Ruggles.
Vermont.—George Hammond.
Wisconsin.—J. H. Warren.

A MEMBER. I move that the chairman appoint a committee of three on credentials, and a committee of three on permanent organization, and, if I could get a second, I should move that the committee on permanent organization make up its list for each of the four conventions from names to be selected by the States themselves.

The above was put in the form of a motion, and agreed to.

A MEMBER. With regard to those appointed to represent a State or college in a certain division, would they be considered as members also of this body?

The CHAIRMAN. Certainly; and they will be authorized to represent in the body whatever State they hail from. On the committee on credentials the chair appoints Messrs. Schwitzer, of Missouri, Clark, of Vermont, and Waring, of Massachusetts. The next business is the choice of a committee on permanent organization, and under the motion of the convention it will be necessary for the representatives of each State to select their own member of that committee. This committee should select a chairman for each one of the conventions, and their vice-president and secretaries. The chair would suggest that perhaps a recess of ten minutes will enable the several delegations to consult as to the selection of its member of this committee.

Mr. **Schwitzer**. I move that the convention take a recess of ten minutes.

The motion was agreed to.

The convention was called to order at 12.05.

The **Chairman**. The chair will now call the States for the report of their representatives on the committee on permanent organization.

The roll was called and responded to as follows:

California, C. P. Berry; Connecticut, D. S. Gold; Illinois, G. E. Morrow; Maine, C. A. Gilbert; Maryland, Allen Dodge; Massachusetts, Prof. C. V. Riley; Minnesota, Edward D. Porter; Missouri, P. Schwitzer; New Jersey, Prof. George H. Cook; New York, Henry E. Alvord; North Carolina, J. A. Holmes; Vermont, George Hammond; Virginia. Dr. J. N. Page; Wisconsin, George E. Bryant; Colorado, A. E. Blount; Tennessee, Professor McBride; Indian Territory, Gov. Allen Wright.

The committee then retired for deliberation.

The **Chairman**. I have a communication from General Hazen, the Chief Signal Officer of the government, in which he states to me that he has requested Lieut. W. E. Berkheimer to take such part in this convention as he can properly. This is surely very kind indeed of General Hazen, for no more vital question can be discussed than that of the relations of meteorology to agriculture. I would therefore suggest that Mr. Berkheimer be requested to represent the Signal Service in the convention.

Mr. **Porter**, of Minnesota. I move that he be admitted as a delegate, and, in addition to that, that he be requested to prepare a paper upon the relations of meteorology to agriculture.

The motion was agreed to.

Professor Holmes presented the report of the committee on permanent organization, as follows:

The committee on organization nominated the following officers of the Convention on:

Chairman, Dr. Geo. B. Loring, of Massachusetts, and one vice-president from each State represented.

Secretaries.—George E. Bryant, of Wisconsin, and Henry E. Alvord, of New York.

JAS. A. HOLMES,
Secretary of Committee on Organization.

Mr. **Schwitzer**. I move that the report be adopted.

The motion was agreed to.

The **Chairman**. The report of the committee seems to have created the necessity of the temporary presiding officer going on for a while longer. You will see by the programme that this day is set apart to the agricultural colleges and agricultural societies for the discussion of the general principles of farming, and of those questions which belong to agricultural education and the organizations of schools, colleges, and associations.

The first paper on the programme is an essay by Professor White. I understand that this gentleman is not present. Mr. Cook's paper on "Agricultural Education in New Jersey" is the next on the programme, and the convention will be glad to hear from him.

Professor Cook read the following paper:

AGRICULTURAL EDUCATION IN NEW JERSEY.

That a liberal education was needful for those who were to fill the professions of divinity, law, and medicine has been acknowledged and practiced on from the earliest ages. But it was not till recent times and the great advancement in physical and experimental science that men began to see the benefits which learning could bring to those practicing the common arts of life. And now, when this is known and acknowledged by all, there is yet a wide diversity of opinion as to how this learning shall be acquired, and how made available for the greatest number of persons. Shall it be taught in the common schools? Shall it be given by instruction in industrial schools? Or shall it be by the thorough training of young men in the highest branches of learning and science? Or shall technical schools take the place of colleges, and instruction be given only in the special lines in which their future pursuits lie?

For many departments of mechanical and manufacturing industry these questions are becoming well understood, and have been carried out in practice. At a meeting of civil, mechanical, and mining engineers held at Philadelphia during the Centennial Exposition in 1876, this subject was ably discussed. In addition to representative men from all the great branches of industry in our country, there were present able men from England, Germany, and Sweden, who took part in the discussion. It was very remarkable that, without a dissenting voice, the large number who spoke all took the ground that the proper education needed for any young man who wished the best preparation for industrial or business life, was the same as for professional life; that he must begin with a broad and liberal course of study in languages, mathematics, and philosophy, and in the principles of natural, physical, and chemical science. After that he may enter upon the study of his chosen profession in any of the technical schools which may suit his purposes, and then he can go out well prepared to enter upon practical work. A very few of the speakers thought that after the collegiate training in methods of study and research, the student would do best to go out and work in his chosen pursuit for a while, and then take up his course of technical study. The latter plan, however, was by most thought not to be adapted to the habits of our young men—to be impracticable.

It was interesting to follow the course of thought of the writers of the numerous papers read, and to see how the whole of them reached the same definite conclusions. They were all *specialists*, working in narrow, comparatively well-defined and productive lines of duty. There were men representing the great railroad interests of the country, others representing the canals. There were the managers of the immense coal and iron mines, the blast furnaces, the steel and iron manufacturers, the architects, and builders, the machinists, the men who manage and direct the power of wind, of water, of steam, of electricity, of explosives, and whatever can either replace, supplement, or make human labor more effective. They represented that division of labor which enables a man to concentrate his attention and energies upon a single subject, and to get from it results which in the old way of working were never thought of.

It is not surprising that such men should know the value of sound learning, and of broad and liberal culture, as the foundation for superior attainments in any line of special work.

While this is the case with so many departments of industry, it is not so, or at least it has not been so, with agriculturists. With them it has been the fashion to consider farming as an art, or a number of arts, all depending on practical skill, and not needing the study of any principles whatever. Some years since I visited what was called an agricultural college, where were gathered more than a hundred large boys and young men as students. They were hearty-looking, muscular fellows, but so dissimilar in size and apparent maturity, that I inquired of one of their teachers how it happened that the students were so unlike in appearance. The answer given was that probably there was not one among them who had not been at some other school, and been dismissed from it on account of inability to keep up with others in his studies. Their friends had then sent them there to learn agriculture. What a slur upon agricultural science! I am happy to say that though the institution is still going on, and is well known, it is not in our country. But something of the same spirit exists in the minds of many with us. Our agricultural colleges are besought to take boys and young men who have scarcely a knowledge of the fundamental rules of arithmetic, and know nothing of the rules of grammar and of writing the English language correctly, and to teach them the theory and practice of farming—to teach them, without preparation, the methods of study and investigation which are occupying, and which require, the full powers of the best-educated men. It is hard to make such persons understand the real difficulties of agricultural study, and the necessity for preparatory education in order to pursue it advantageously. They look upon farming as a trade, and the knowledge of it as contained in a set of rules.

But something more than this is needed, and as the objects which have occupied the farmer's attention are diminishing in number, he can see more plainly the condition and wants of those which remain. The removal of the spinning-wheel and the loom from the house has taken off many distracting cares. The making of butter and cheese in the large way, instead of by each household, takes away much drudgery and waste of time and attention. The improvement and cheapening of farm implements have rendered labor vastly more effective and shorter in duration than of old, and the facilities of communication have enabled men to pursue with profit the specialities which best suit their tastes or circumstances. In short, it is the *division of labor* introduced into farming which is bringing it forward into the same rank with those important but simpler occupations which, by their very simplicity, have been sooner mastered and understood in their principles and carried out in practice. It is the addition of the study of physical science to the old and well-known branches of education which has given the practical efficiency to learning in modern times. There is still a vast field to work upon. How shall we proceed to work it most profitably?

The provision made by the United States Congress for the establishment of "colleges where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life," was a wise and timely one. It recognized the important fact that *colleges*, that is the highest institutions of learning, are needed to educate farmers, and that this education shall be first liberal and then practical. The men who drew this law understood the value of education and its relations to the industrial arts. The different States of the Union have received the grants under this law and applied them in the ways which their people have thought best adapted to their wants. In our State of New Jersey, the legislature appropriated the interest of the fund accruing from the government land grant to the support of teachers in the scientific department of Rutgers College in New Brunswick. This college was an old and well-established institution with a scientific school for one of its departments.

The partial endowment by the government fund has brought together more fully the classical, mathematical, and scientific studies which are necessary in any course of liberal education, and then elective studies in different branches of learning have given the practical bearing which furnishes direction and interest to the studies of aspiring young men. There are laboratories where chemical analyses are constantly going on; the astronomical observatory is open for practical observations and study; the geodetic and topographical survey of the State gives practice with study for some of its students; the geological survey of the State is constantly furnishing new illustrations of applied science; the farm of the Agricultural College has experiments constantly in progress on the cultivation and fertilization of crops and the feeding and profit of stock, and the State Agricultural Experiment Station, with a laboratory always open, is in communication with some thousands of farmers in all parts of the State. All these are the means provided for benefiting agriculture and the industrial arts.

Of the thirty-eight States in the Union, New Jersey is among the smallest, being the thirty-fifth in size, but in population it is the nineteenth, containing 1,131,116 inhabitants, one-forty-fourth of all in the United States. In wealth and capital it is the eighth. Its productive industries are very largely manufacturing and mining, while agriculture, which was formerly a leading industry, has now to take a secondary place. Not that it has grown less, but that others have outgrown it. The State has most extraordinary advantages for agriculture in its climate and soil, and in its nearness to the best markets of the country. But the manufacturing cities and towns within the State and the great cities of New York and Philadelphia on its two sides furnish attractions for both capital and labor which promise larger and quicker returns than can be obtained by the slower but safer and more certain profits of agriculture. Of capital, agriculture has $260,000,000; manufactures, $79,000,000. Of products, agriculture has yearly $42,000,000; manufactures, $170,000,000. In this state of affairs young men who are educated and desire to turn their education to the most profit, seek their first employment in other callings than farming, and this is the case with farmers' sons as much as with any others. Besides the smaller capital required in other callings, education is more highly appreciated in them and those who have it are better paid. Young men may fill our laboratories and may investigate subjects which are of the first importance to farmers, but there is no farmer who will give them better pay than they give uneducated laborers, and the young men cannot, without farms, apply their knowledge of agricultural principles to their own profit. Like prudent men they do not run in debt, but they go into the business which pays them best till they can pay for farms, and then they will return to them.

There are large portions of New Jersey, perhaps the largest part, where farming cannot be profitably carried on without the use of chemical or other commercial fertilizers. The purity of these fertilizers can only be determined by chemical analysis, and their action on crops can only be ascertained economically by faithful and carefully-planned experiments. The interests involved in these fertilizers are enormously large and the savings to be effected by their judicious application are enough to turn what may have been a losing business into a profitable one. Again, the savings to be effected by consuming all the coarser fodders, instead of wasting them in heaps of refuse, are more than enough to pay the expenses of the best of our agricultural colleges. It is essential that farmers be instructed as to the real interests and importance of their own calling, and that they treat it with becoming earnestness and dignity.

To accomplish this end, and it is the greatest that now occupies the friends of agricultural improvement, more attention must be given to the investigation of those subjects which have their application in the cultivation of the soil and the increase of its products. The men for these investigations must come from our higher institutions of learning. Education has never begun with the improvement of the common schools, but always with the establishment of colleges and institutions where advanced and liberal education could be given. The history of every State contains examples of this—colleges and academies have been first established, and afterward, and sometimes very long afterward, common schools have been established. And this is both natural and reasonable. Teachers must be supplied before the scholars can be taught, and the higher institutions must be established to fit the teachers for their work. This is so plain that it hardly needs mentioning, but it has not been fairly appreciated and it has not been carried out as fully and successfully as it ought to have been. The excellence and value of the knowledge acquired in these institutions for other pursuits has been so highly appreciated that most of their graduates have been able to enter upon positions which better suited their tastes, or were more lucrative than was teaching in the schools. This has been true of all our colleges, and also of the institutions mainly devoted to instruction in higher English and scientific studies. A remarkable example is seen in the Rensselaer Polytechnic Institute, at Troy, N. Y. This institution was the first of its kind in this country, being established in 1824 by the Hon. Stephen Van Rensselaer, of Albany, and endowed in part by his family. Mr. Van Rensselaer established it to give instruction to young men in chemistry, natural philosophy, geology, mineralogy, botany, and kindred subjects, so that they might go out as lecturers and teachers to instruct farmers, mechanics, manufacturers, and others engaged in industrial occupations, to enable them to lighten the burdens of labor and to enlarge its products and profits. The institution was placed in charge of the late Prof. Amos Eaton, and it has proved an eminent success in its teaching; it is still in successful working. Its students are gathered from all parts of our land and from foreign countries. Some of the students have been college graduates, others have only received a previous high school education. Its graduates are to be found in every department of industrial life, and occupying prominent places as executive or as investigating men, and exerting a wide influence for good. A few of its graduates have engaged in teaching, but the most of them have found employment and better encouragement in other kinds of work. In its main object the institution is but partially successful.

The same experience has followed the efforts for collegiate and liberal education throughout our whole country. The institutions have been of great advantage to those who have been able to come within their influence. They have been the making of a large portion of our leading and influential men; but they have not sent out enough of the best qualified teachers.

And there are not enough such institutions, especially of those well equipped with men and appliances for teaching thoroughly what the men who are to take the lead in industrial pursuits need to learn. Such teaching is necessarily expensive; the cost of roomy buildings, of libraries, of apparatus and materials for experiment and research, of specimens for illustration and study, and most of all, of men competent to teach, to investigate, and to write, is large. It cannot be met by the fees of those who are to learn. It never has been, and it is less likely to be now, when the necessity for expensive appliances increases with the advance of physical science. Neither is it desirable that the benefits of such education should be limited to those who happen to have the means to pay the fees which would be required.

Our older colleges were established mainly through the efforts of professional men who wished to have their successors liberally educated, and their endowments were from the private funds of generous and far-sighted men. But now that liberal education is needed for industrial men as well as for those in what have been called the learned professions—when, in fact, the higher departments of all the pursuits of life need to be filled by educated men—the provision to accomplish this end must be made at the public expense. I do not mean to say that all or even the majority of men are to receive education in our institutions of higher learning, for most of them have neither the aptitude nor the ambition to do the hard studying that is required. But the institutions should be opened and easily accessible for those who give evidence that they are qualified to benefit by them. And the number to avail themselves of their teachings should be greatly increased. As teachers of advanced learning, as investigators of unsolved problems in science and in practice, as men of intelligent executive ability, they are needed everywhere.

Take for illustration the New Jersey Agricultural Experiment Station. This has been established to protect the interests of farmers, and to make investigations for them, such as are plainly of general importance, and yet such as individual effort cannot afford to work out. There are more than a million dollars' worth of chemical and other commercial fertilizers consumed by farmers in the State of New Jersey every year. These are bought on the representation of interested parties without any power to judge whether they are what they profess to be or not. The experiment station secures fair specimens of such fertilizers as are in market, analyzes them and then calculates their value as compared with that of other fertilizers which can be bought. These analyses are printed in the form of a bulletin, and sent by mail to every farmer, dealer, or manufacturer in the State who has signified his wish to see them, and also to every newspaper in the State, or that circulates in it. The list to whom they are sent now numbers 2,000, and is constantly increasing. The cost and value of the fertilizers is, of course, first looked at by the farmer, and the poor ones are being rapidly discarded and withdrawn from market, and a great saving in cost of manure is effected. But besides this, the bulletins become educators to the farmers. They see from the analyses what constituents enter into the fertilizers, and are learning from their own experience which are of use to them and which are wasted on their soils. The growth in the intelligence of farmers in this respect is great and is constantly going on. In the feeding of animals the experiments are equally important. Chemical analysis shows what are the essential elements in the fodders which are commonly given to cattle when they are to be kept in thrifty condition. It is the custom everywhere to feed such fodders as will answer this purpose. But the farmer also has various coarse and rough products which only partially answer for the support of animals, such as straw, chaff, corn-stalks, &c. The addition to them of some small and inexpensive waste products makes them complete foods, as nutritious as the best timothy or clover hay, while their market value is much less. Near our great cities such waste or low-priced products as brewers' grains, cotton-seed meal, malt screenings, bran, &c., can be used to complete a ration which is nutritious, palatable, and economical. Last winter, while the daily ration of clover hay for a cow was worth 27 cents, the ration composed of straw, brewers' grains, cotton-seed meal, &c., could be made up for 19 cents. The cows yielded as much milk and increased in weight as much with the latter ration as with the former. And the daily saving by the mixed ration was 8 cents, or 30 per cent. on the cost of the hay.

These experiments are still in progress, but when it is remembered that there are 152,078 milch cows in the State, the magnitude of the saving which it promises to make becomes of public importance. It would amount in a year to $4,440,667, and it can be seen that the subject is well worthy the attention of scientific men, and fairly demands all the aid they can give it.

Another subject of investigation with us just now is that of ensilage, or the proper preservation and value of green fodder cut up and preserved in pits where it can be protected from the air. That it can be preserved for months in this way, and that stock of all kinds will eat it with avidity, is now well known. But whether it has all the nutritious qualities it had when first brought from the field is not so well proved. The enormous crops of Indian corn which can be grown in this way have very properly excited the interest and raised the hopes of enterprising farmers, and it is certainly teaching them to largely increase the products of their farms. There is, however, a considerable loss by fermentation of the sugar in it, and it becomes a question whether, after being preserved in this way, it is any more nutritious than the same cornstalks dried in the open air. The cattle eat it clean, which is certainly a saving over the feeding of the cornstalks dried in the common way. But if dry cornstalks can be cut and crushed so that cattle will eat the whole of them clean, it becomes a question of great theoretical and practical interest as to which method is most profitable. This question we have now in hand, but it is not yet satisfactorily answered.

The growth of sorghum and the production of sugar from it have been the subject of experiment with us the past season. The varieties to be grown and the fertilizers to be used have been tried upon the college farm satisfactorily, and the results thus ascertained, together with the trials on a manufacturing scale at the sugar-house in Cape May county, give strong confidence that this will add a new and profitable branch to our agricultural industries.

These investigations bring the scientific student directly in contact with the practical farmer. The experiment station becomes the educator of the working farmer. The dissemination of the results of well conducted experiments and analyses among farmers quickens their efforts to get the benefit of such results. The composition of the fertilizers the farmer has to buy, and the feeding value of the different foods and fodders on which he can support his stock, furnish the data from which the working farmer and his sons can calculate what plan will be most profitable for them to pursue. Such information stimulates inquiry, rewards careful and judicious enterprise, and is to-day the best teacher for the great body of workingmen that has ever been brought into the field.

The agricultural colleges are at their best and legitimate work when they are training men for the work of investigation; for determining the best methods of applying known principles for settling those which heretofore were unknown, and generally for doing work such as is for the common benefit of all classes of the community. There is need that those we have should be more liberally supported, and that there should be many more of them. The experiment station takes up the work where the agricultural college leaves it, and carries it forward till its benefits are experienced and enjoyed in every household and upon every farm.

The two institutions work together admirably, and are doing well and satisfactorily that which has been so much desired by those who know of the dignity and efficiency of well-directed labor in every department of industry.

The reporter left the room during the reading of the above, and when he returned Mr. Gold was speaking. He is therefore reported only in part, as follows:

Mr. **Gold**. * * * Is not there an opportunity to show that the farmer does not get such a very poor living as statistics would make it appear? Doesn't he eat an egg once in a while that he doesn't report as an agricultural product, or some other good things that go on the farmer's table, that he is accused of selling? I believe we are met together to represent the farming interest, and I would not like to see this convention allow that to go without an explanation.

Professor **Cook**. I agree with him entirely, and believe that our statistics should include everything. We might then hope to attract the attention of the young men—they who ought to go to farming.

Mr. **Berry**. The point that discourages young men very much is the income that comes to the young men in trade, and they are likely to follow that which promises the largest income, without considering the failures in trade. The statistics should show to what extent is the farmer his own patron, how much does he draw from his own resources, what are his sales to others, what does he consume himself.

Mr. **Hedges**. It seems to me that a fair rate for a man's living can be obtained by taking the population of agriculturists and charging up for their board the ordinary expenses for this and for clothing. It seems to me we might get at an approximate estimate in that way.

The **President**. The essay also dealt with certain matters which belong to the agricultural education—its objects and profits. This is a legitimate subject for discussion under the call of this convention, and the chair would be very glad to hear any remarks that can be made upon Mr. Cook's suggestions. Some of them were made with great clearness. It would seem that young men after getting their education from the colleges find no profitable use for it, and I doubt not there are gentlemen here connected with the colleges who are able to take it up and explain it.

Mr. **Fernald**. I do not rise because I think I can give any explanation, but for the purpose of adding further testimony to the fact which the essay has brought out that our young men pursuing courses of study in the State colleges of agriculture and mechanic arts find larger inducements to go into some other professional calling than into the profession of agriculture because the returns are so much more immediate. Now, at the institution where I have the honor to preside, the young men find that if they pursue a course of engineering they can get immediate employment on graduating from the college, through which they have the means of paying the bills they have contracted. As civil or mechanical engineers they get liberal returns, whereas the young man who pursues a course in agriculture finds, as has been stated in the paper, that if he gets out of employment he can get only moderate returns for the labor of his hands; hence the inducement seems to be on the side—following one or the other pursuits—either of civil or mechanical engineering. I think it would be a very important service to the cause of agricultural education if this convention, or any association or party of men or body of instructors, could devise a way by hich young men could be made to see that the returns from the farm will be as ample and as enduring and as advantageous in all respects as from any other following, and that it opens up a field for whatever faculties or powers the student has. It is the difficulty under which those instructing in agricultural institutions constantly labor. They find that the young men have a tendency to go off into other callings, and this tendency exists as largely with farmers' sons as it does with the sons of any other class, and this is encouraged at home. The farmer expects his son to go into such calling as shall give him the most immediate and largest returns. I think this is true in a very large majority of cases, and if the institutions in the other States have the same experience as the institution in Maine has, I have no doubt it would be the testimony of the representatives of these institutions here that they have met with the same difficulty.

The tendency for our young men to be drawn off into other pursuits is because of the fact, as I say, that the returns are not only immediate, but they seem to be ampler. I don't know that they really are more ample, but it seems so to them. Now, in what way can we cause the young men to see that they will realize as largely and as advantageously from entering into agriculture as a profession as from any other? How shall they be induced to see this while other inducements are so strong in the other direction? This is the question, and it is an important one for this convention or any body of educators to discuss, and I wish we might have some light thrown upon it. These are the facts of my own observation. The tendency is strong from the cause I have mentioned.

Mr. ATWATER. My friend, Mr. Fernald, has commenced in a line which seems to me to lead directly toward some of the explanations and some of the answers in which we are mostly interested in this connection. He tells us that the young men come to his institution, and I know what these young men are, because I have seen them, and they are all solid men. They come there earnest and ambitious, with very little money, but with lots of good intentions and a capacity for lots of good work. By diligence, by economy, by a little money from home that comes from selling a few eggs and a few potatoes, and by borrowing a little from Uncle Henry they manage to get through college. They have a debt of, we will say, $200 that has to be paid. Now, it is just exactly as President Fernald has said. John goes out with this debt, and he remembers that there is still a mortgage of $500 on the farm, which his father has not been able to pay. Now, if he can get $60 a month in engineering, he is going there instead of on a farm for $15. Now, what is to be done? It seems to me that among the others there are two solutions of this problem. The change that has got to come about, that I believe will come about, must be a slow one, and among the other things which shall contribute to it there are two. First, show John how to make money on the farm, and how to make better use of his brains on the farm. His Uncle Henry went to the city, his father staid at home. The uncle is a lawyer, and can make plenty of money; he can afford to loan John $200. This uncle was no smarter than the father, but the uncle made his money by the use of his brains. He sees how a smart boy can go into the city and have a prosperous and successful career; he don't see that prosperity on the farm. He don't see men make a great deal of money on the farm.

Professor Cook has told us how, by the application of science, he has been able to get from his breed of cows just as much milk and just as good milk for 19 cents a day as he had been getting for 27 cents a day. He had been feeding clover hay, and had been paying 27 cents a day.

Instead of that, he has fed straw which John's father thought was not worth as much for fodder as his brewers' grain, cotton-seed, and so on.

Now, when John finds out he can go home and feed the stock to such an advantage, he at the same time will see that there is a use in which he can use his brain and make money, and have the satisfaction that always comes from the use of a man's mind. The farmer's boy has two considerations. He wants to be a man of thought, as well as a rich man. To come now to the practical application of that—what is wanted in the Maine College of Agricultural and Mechanical Art, what is wanted in the University of Tennessee, what is wanted in the Maryland colleges and other colleges is the solving of this question: How can we best and most successfully bring forward the movement that is necessary to show John how he can make more money on the farm than his father does; how he can use his brains more on the farm? If John can see some of these experiments going on, and see how and where the money is saved, what a valuable lesson he has learned.

Now the professor (Fernald) will pardon me if I speak of a family matter. I happen to know that in the same institution Professor Balens has been earnestly at work to make experiments of a most valuable character. I have seen him at work. Now, why hasn't Professor Balens made more? He has not the money. He was only able to make that particular experiment last season and the season before by aid of a contribution from a benevolent gentleman, outside of the State, of money to pay for the fertilizers used in the experiment. It is such experiments that John ought to see, and he would very soon come to know how he could make more money on the farm, and use his brains more. The moral of this, it seems to me, is too evident to require further talk.

Mr. ALVORD, of New York, thought one point had been overlooked. The openings for young graduates were rapidly increasing, and it should be understood that every year there are positions upon salaries for young men who have prepared themselves in colleges as instructors or managers of large estates.

Mr. SARGENT, of California, said that young men from colleges in the East who went West to the Pacific slope encountered a condition of things different from anything they had been led to anticipate. He referred to the arid region of California, Utah, Nevada, and Arizona, some portions of which did not have more than two or three inches of rain a year. He desired to know if it was not possible to teach some of the young men who go out there, whether or not there are certain plants which thrive with a slight degree of moisture; whether those plants which need no water have not an economical value there, and if there are not other plants of similar characteristics that may be made valuable? Again, young men should be impressed with the fact that the constant production of wheat, without rotation, is exhausting our soils, and pouring its richness into the sewers of London and Paris.

Mr. SCHWITZER had no doubt that if the results obtained by agricultural colleges in 20 years could be tabulated, it would be found that they had been educating farmers' sons away from the farm. Ours is mainly a country of small farms. The small farmer raises the staples, and it is the business of the agricultural colleges to see to it that he understands how to obtain better returns. One of the causes is to give these young men a liberal education, and upon that a technical education. It is then only a question of dollars and cents. He didn't wish to say anything against the highest education possible, but the small farmer should bebenefited. Limit the education to a certain course, and the young man would go back to the farm.

Mr. **Gold**, of Connecticut, was happy to say that there was established in Connecticut last year, through the liberality of a private individual, who gave a farm of 170 acres, an agricultural school, expressly for the purpose of educating boys that come from the farm, on that farm, and for the farm. They are daily exercised in all the methods of the farm in addition to the studies of the class-room. Boys from the common schools of the State are received. We hope from this small beginning that there will be a multiplication of such institutions in every State, where boys can be educated on the farm, and for the farm.

The delegate from California thought the technical education should not be given before the liberal, and that a system of compulsory work should be adopted. If the work was made voluntary on the student he would soon loose his respect for it.

Mr. **Fernald**, of Maine, thought one other point had a bearing upon this matter. When the institution was started it was difficult to obtain professors of agriculture. "Just in proportion as the Department of Agriculture in the institution is made prominent, in just that proportion will the young men be attracted toward it." Just as soon as they see an opportunity for returns, and a field for their powers, they will go into agriculture as readily as in any other pursuit. Draw them into the department and maintain their interest there. Give them charge of experiments under the supervision of a competent instructor.

Professor **Cook**, of the New Jersey Agricultural College, heartily approved the working of the agricultural experiment stations, and cited cases to prove the necessity for such stations, both in determining the wants of different crops for special kinds of fertilizers, and also the peculiar action which characterizes different soils in regard to the same fertilizer. He considered the work of the experiment station, where the investigations in the laboratory are joined to and proved by experiments in the field, to be the first which has fully met the wants of the practical farmer and the demands of improved agriculture. And further, he had found that the immediate and wide publication of the practical results reached by the stations was an admirable method of teaching farmers the principles of their art. Such stations quicken inquiry among farmers, stimulate them to exercise their skill and intelligence in pursuing their business, and give them the assurance that science applied to agriculture brings as sure and as large returns as it does in any other department of industrial life. With these additions to the practical working of our agricultural colleges the young men who graduate from them may safely be left to choose such industrial pursuits as best suit their means or tastes. Agriculture will certainly claim and receive its full proportion of them.

Professor **Roberts**, of New York, stated that his experience had been different from those who had preceded him; he had no difficulty in persuading students at Cornell to return to the farm; no difficulty in finding places for those who wanted to work on salary when they were properly prepared.

Mr. **Hedges**, of Missouri, stated that he had just returned from the South, and in opposition to Horace Greeley's advice to "Go West," he should advise all young graduates to go South; that there they would find good salaries and pleasant occupation.

Dr. **Elzey**, of Virginia. I have had some experience in agricultural colleges as a teacher. I agree with Mr. Fernald, of Maine, that the agricultural department of the institutions should be made more prominent. I have had considerable experience in the State of Virginia where the agricultural department has been hitched on as an adjunct to the University, and which has had the result of educating men in the wrong way; if the young men were not educated as engineers they would not follow that profession after graduating. Put the agricultural department to the front, not in the rear. His experience in Virginia was that the agricultural department was subservient to even the military. Young men should be taught to advance agricultural science. If you cannot teach him how to cultivate his land without reducing its natural fertility, agricultural science is a failure. Develop the feature of agricultural advancement first, and attach the university feature afterwards if necessary. Educate a man so that when you put him down in any part of the country he will be able to say what system of agriculture will succeed in that section, his knowledge being based upon the science which enables him to work at the system which shall pay him a reasonable profit without robbing the owner of the land by taking from the soil its natural fertilities. Dr. Elzey dwelt at length upon his experience in the agricultural college of Virginia, and stated that the question as to where plants obtained their nitrogen had never yet been answered in any of the agricultural colleges.

Mr. FERNALD, of Maine, said that there were many stations that were endowed by the act of 1862, working upon the nitrogen problem; that the endowment was for State colleges of "agriculture and mechanic arts;" that the whole needs to be looked after, otherwise they fail to carry out the purposes for which they were founded. He would not have it understood that graduates of the colleges pursuing a course upon agriculture turned out engineers, for they did not.

Mr. BUCHANAN, in reply to Dr. Elzey, said that, in his opinion, the college of Virginia was doing well and good work, and that his experience led him to differ from the views which Dr. Elzey had expressed.

Dr. ELZEY desired to correct any misapprehension relative to his remarks upon the condition of the agricultural college of Virginia, and wished to say that since Mr. Buchanan had been at its head its status had very much improved.

Professor CALDWELL, of Cornell, desired to say that he thought the agricultural colleges have been guilty to a large extent of all the accusations that had been made against them. They had departed widely from the purposes for which they were originally created. The trouble had been that the right kind of men could not be found to conduct agricultural colleges. Students studied law because they can get more money by being lawyers, and engineering for the same reason. Until the same thing proves to be true, by experience, in the case of agricultural colleges, this will continue to exist; until farmers' sons see that young men who graduate as agriculturists are more successful they will not go and do likewise.

The PRESIDENT. The chair desires to say that any gentleman who was present at the last convention held in this room and is here to-day must see the immense progress that has been made in agricultural education since that time. Some of the strongest men in the country engaged in the debate on that occasion, but it was evident that few of them comprehended its true value and importance. Since that day a great change has taken place. I see now no reason for any discouragement. I presume there never was a college that did not have some period in its existence in which its fate appeared to be somewhat doubtful. But no doubt should now remain with regard to that business interest for which the students of agricultural colleges are educated. As a profitable occupation it is now recognized. I have always said that there is no such thing as unprofitable agriculture in the hands of an honest, faithful, intelligent farmer. The earth has never yet failed to respond to a wise and proper demand. There are mistakes in farming, to be sure, as there are in other branches of business; but you take the community generally, and you will find that agriculture is as uniformly profitable and yields as generous returns as most of its associate industries. True, there may not be so many individual instances in the East, but there are in the West, farmers who would not exchange their farms for any business within their grasp. I visited, last autumn, some of the extensive farms in Illinois, Iowa, and Wisconsin, and I looked upon the agricultural enterprises of these various States as one who never had an idea of our eastern industries would look upon the great manufactories of Lowell, or Waltham, or Lawrence. Some of these farms are as imposing in all their business proportions and as encouraging to all the economies of State as are these great mills to which I allude. Nor is this the only section where I have had the pleasure of witnessing the growing, progressive, advancing agricultural enterprises of the country. I desire to bear my testimony to what I have seen in the South. I perceive there, a manifest desire to leave those things that are behind, and to press forward to those that are before. The gentleman from South Carolina (Mr. Aiken), who is present, knows very well that everywhere in his own State, and other States of his section, there are evidences of advancing steps in the way of diversified and profitable agriculture. The great cattle interest in the West is as sure a mode of profit as is any well organized commercial interest. What better evidence than these can one have of the success which is sure to follow the application of the sturdy common sense of an agricultural community to the business of farming.

As I come East I see another system adopted with sound judgment and enterprise—a system which will ultimately extend throughout this country. It is the cultivation of special products devoted to local markets. Many an acre of land in the vicinity of our large cities is said on good authority to yield a thousand dollars annually. In my own neighborhood in Massachusetts there is land that pays the cultivator $250 and $300 per acre every year. You may see there good farmhouses and barns, the people cultivating their minds, accumulating libraries, and in every way striving to learn their duties as American citizens, and their obligations to the community and State in which they live. There is in the business of practical American farming the basis of our best civilization, the best intelligence, and a broad and enlightened state policy which is not equaled anywhere on the face of the earth. [Applause.]

Now, if we have proved that our farming communities stand so high among those of the rest of the world, you may ask what is the necessity of agricultural science? For myself, I think the necessity for accurate endeavor is in proportion to the value of the occupation. Hence it is that we of all people need the aid of science in order that we may teach those laws of farming which shall make both the general and special agriculture to which I have alluded more systematically and accurately carried on.

Now, when I am told that young men who graduate from these colleges avoid agriculture and adopt engineering as a profession the reason at once suggests itself. It is much easier to graduate an engineer than it is a farmer. Every man knows that if he were running a railroad he would find it easier to secure an engineer for his road, or mechanic for his machine shop, than would his neighbor, who owns a thousand acres in Virginia, to find a man to organize his force and manage his land. You can graduate lawyers who will carry you through all the intricate windings of the courts, or physicians who are renowned for their skill, but when you come down to this business of agriculture and would find a man whom you are willing to employ as an expert you are involved in difficulty at once. And yet there is no want of liberal compensation in this calling. Give me one hundred good horticulturists, competent to arrange vineyards in California or market gardens near New York or Boston, or to adapt themselves to the various systems of farming with their knowledge of the several branches of agriculture and horticulture, give me one hundred such men, and they can find employment at once. There is an abundance of it everywhere. The demand for such is greater than the supply. I have hardly known an instance where the owner of a large estate could go to a college and assure himself that he could find there a man qualified in every way for his purposes. Take moreover the business of veterinary surgery. There are investigators here who have for a long time been struggling to solve certain questions relating to the application of that science, and in every step they have made thus far they have felt the need of a strong, powerful, educated veterinary corps to take these matters in hand. We have them, to be sure, in individuals, but they have hardly yet established themselves in this country as a strong body of scientific investigators, whose opinion is accepted as law. Give us a corps of veterinary surgeons, graduated from the agricultural colleges of this land, and let us see how long it would be before their services would be in demand.

The same thing applies to market gardening. There are those who, by their ingenuity and skill, are equipping themselves for that profitable industry; an industry whose growth has been so rapid that its importance and value can hardly be estimated.

It becomes each year more and more necessary that we should know how we can better manage and utilize our labor. Teach your young men those things which shall enable them to present themselves properly to the owners of large estates, and there will be no further fault found with reference to their immediate employment. Teach your young men how to keep the buildings in good order; how to select and breed and feed their cattle; how to systematize the whole business of farming. There are no people so imitative as farmers; none who watch their neighbors so closely, criticising the affairs of adjoining farms while taking care of their own; none who estimate more highly the value of good example. There is no reason why young men should be discouraged, or why teachers should be discouraged as to the effect produced upon students by the teachings of these colleges. President Garfield used to tell a capital story of a cultivated and intelligent and practical gentleman who, when asked what benefit he had ever derived from his knowledge of Latin, replied: "Perhaps no special benefit from the Latin itself, but I have derived some benefit from the fact that I once knew it so that I might forget it." The agricultural colleges can infuse a degree of enthusiasm and love of practical science into the minds of active and vigorous men, by placing before them the agricultural problems of the day, which will produce an immense effect upon the agriculture of this country, and which will tell throughout this whole land.

You will excuse me for making these remarks, but I desired to say something that would remove every suspicion that the agricultural colleges are a failure.

The colleges can succeed; they do succeed; and I insist that they will be a source of immense benefit to this country in coming generations.

I have never heard a better discussion upon agricultural education than I have heard this morning. It is suggested that there is now to be read a paper that will possibly take up what has been alluded to, and if it be the pleasure of the convention it will now be read.

Mr. **PEABODY.** Such a paper will naturally involve considerable discussion, and I am disposed to move an adjournment unless there be some other matters of a temporary nature to be taken up.

The **PRESIDENT.** Are there any suggestions as to the hour to which we shall adjourn?

Mr. **PEABODY.** That is a matter which I shall leave to the gentlemen or chairman.

The **PRESIDENT.** We will probably have three or four essays to dispose of before the end of two days. I am perfectly willing to leave it to the convention.

Mr. **HEDGES.** I move that we adjourn until half past seven this evening.

The motion was not agreed to.

The convention then, on motion, adjourned, at 3.48, until 10 o'clock to-morrow morning.

JANUARY 11, 1882.

The convention was called to order at 10.20 o'clock a. m.

The **CHAIRMAN.** If any delegates have arrived since yesterday's meeting, I would request them to register their names at once in the book provided for that purpose. I would request them, in addition to giving their names, to give their addresses, as the others have. It is not necessary, in a deliberative body like this, to submit the proceedings of the previous day. It is merely a record of what was said, and cannot possibly be submitted. I desire to say to the convention that the hours for deliberation will be from 10 o'clock to 1, and from 2 to 5. This will give the members an opportunity for lunch at 1 o'clock. I think, in that way, the convention can be more systematically arranged. I will state that there has been a request made that a resolution should be offered limiting debate to ten minutes. For myself, I somewhat object to this, as the discussion consists largely of papers, and prefer very much to leave it to the good sense of the members of the convention what time each one should occupy in discussing a paper. I know many gentlemen, in discussing great subjects like these, which would be subject to a vote, want more than the ten minutes suggested, and ought to have it. I am perfectly willing, as presiding officer of this convention, to leave to the judgment of each member how long he shall talk, or what he shall have to say. The paper that will be read this morning will be as upon the programme—the paper by Professor Caldwell upon "Experimental stations as an educator of the farmer." That will be followed by another paper by Professor Atwater upon "Co-operative experiments." Before Professor Caldwell reads his paper, I have a communication to lay before you from Mr. Blackburn, of the committee of the National Fair Association—an important association—on whose grounds I rather expect and hope, at least, that some large national agricultural fair will gather at some future day. They have excellent arrangements there, and I am sure that the grounds will be interesting to many gentlemen present.

WASHINGTON, D. C., *Jan.* 11, 1882.

DEAR SIR: On behalf of the National Fair Association, I most respectfully request you to invite the delegates now in attendance at the National Agricultural Convention to visit the National Fair Grounds, at such time as may suit the convenience of the convention.

Very respectfully,

H. H. BLACKBURN,
Committee, National Hotel.

HON. GEO. B. LORING.

I have stated to Mr. Blackburn that we had better wait until fair weather. You will have to leave by the Baltimore and Ohio road at twelve o'clock. It is only ten-minutes' ride from the city. I will request the delegates to give their names and the titles to any papers proposed to be offered that they may be arranged in the programme. The paper now to be read will be a paper by Professor Caldwell, upon Experimental stations.

THE EXPERIMENT STATION AS THE EDUCATOR OF THE FARMER.

BY PROF. G. C. CALDWELL, *Cornell University, Ithaca, N. Y.*

We are told that the first experiment station in Germany had its origin in a craving of the farmers of a certain part of the country for more knowledge; its establishment came about in this way: In the year 1845, in a petition addressed to the Saxon Government by Friedrich Ludwig Riessner, and others, attention is called to the change in agricultural opinion since the sagacious chemist, Liebig, entered the field of agricultural chemistry with his investigations—to the ready reception given to his new ideas all over the civilized world—and to the evidently wide-spread feeling that chemistry should be made more useful to agriculture than had hitherto been the case, and to the importance of the continuance of these investigations for the elevation of agriculture, and the consequent improvement in the general welfare of the country; great stress is laid on the value of the better acquaintance with the soil that may be gained by the study of its chemistry, and of the application of chemistry to the examination of manures, and especially of the artificial manures which must come into use if the productive power of their soils is to be maintained; observing that since the introduction of the use of bones into England for manure the yield of her acres had been doubled, attention is called to the folly of exporting bones and oil-cake to that country, and sending to the South Sea Islands for guano; the eagerness of the English farmer is shown to make use of all the aid that chemistry can give him, notwithstanding the large crops that he is already getting, and as evidence of this it is stated that two agricultural societies, one in England, the Royal, and the other in Scotland, the Highland and Agricultural, have since two years employed chemists, whose sole work it is to give advice to the members of the respective societies, and to make analyses of soils and manures for them, and that even Liebig has been called to England several times for advice. It is therefore petitioned that for each circuit district an able young chemist shall be appointed by the state, to be called the agricultural circuit chemist; it shall be his duty to attend all the agricultural meetings of his district, to give the aid of his scientific knowledge, and at the same time to add to his own practical knowledge of agriculture; to give lectures at suitable times and places to farmers on agricultural chemistry; to analyze soils, manures, &c., whenever called upon to do so; from time to time to travel through his circuit for the purpose of informing himself as to the condition of the agriculture of every part of it, of giving chemical counsel and instruction, and of interesting the farmers in agricultural experimentation for themselves. The petition was not granted, on the ground that the mass of the farmers of the state were too ignorant to derive much benefit from such an establisment; they would need to be instructed how to make use of it to their advantage; but, at the same time, it was generally believed by intelligent and scientific men that under the right conditions, circuit chemists, performing such work for agriculture, might accomplish very much for its advancement. As the result, however, of the agitation of public opinion which the very general discussion of the petition produced, Adolph Stockhardt was appointed professor of agricultural chemistry in the Academy of Agriculture and Forestry at Tharand, in Saxony, and on the erection of a new academy building a well appointed laboratory was provided for the new professor. His duties were to consist in part in giving popular lectures on agricultural chemistry at meetings of farmers' clubs, in performing, so far as his time would permit, such analytical work as might be sent to him by farmers through the minister of the interior, and in conducting experiments for the advancement of agricultural science. The agricultural papers of the time, as well as the excellent little agricultural-chemical journal which he himself conducted for a period of several years, testify to the zeal with which he entered into this work, and give evidence of the important part which he took in the rapid progress made by agricultural chemistry at this period, when Liebig was also devoting a large share of his energies to this branch of the science in whose every department he has made himself so eminent. But the facilities for field experimentation at the academy were inadequate; application was made to one of the most prominent agriculturists of the state for aid in securing something better for the purpose, the final result of which was the establishment of the first experiment station in Germany, largely through this gentleman's liberality, on a portion of his own estate at Möeckern.

Baron Liebig, a thoroughly scientific man and an enthusiastic investigator in chemistry, brought his knowledge, enthusiasm, and experimental skill to bear on the application of his favorite science to a practical art, in which, perhaps, more than in any other industry, there has been a mere following of old ruts, and consequently scanty progress for many generations; a new light broke in upon the old art, and the desire to see and get the benefit of this new light was the first beginning of the stirring up of public opinion, which ended with the first agricultural experiment station. You are not unacquainted with the rapid growth of this idea, peculiar, I believe, to agriculture, of special institutions whose main and in many cases sole object is the scientific investigation of questions arising in or concerned with its practice, for the purpose of improving that practice; you know that from that seed planted in 1851, at Möckern, in a very unpretentious way, with the now famous Emil Wolff as director to nurture it, on the modest salary of 300 thalers, or about $225, a most vigorous plant has grown up in Germany, and that the seed has been carried from that country to every other country where agricultural progress is a matter of any importance to the welfare of the people. Almost every year since 1851 has witnessed the establishment of one or more experiment stations in Germany or elsewhere, and we find them now in Italy, Switzerland, Austria, Russia, Sweden, Norway, Denmark, Holland, Belgium, France, Spain, Great Britain, and the United States; and not only do we see every branch of agriculture represented, even to wine production, olive culture, and silk culture, but other practical arts have taken up the idea, and we have experimental stations for beer brewing, and for the manufacture of spirits and of sugar. It is the duty of the scientific men, gathered at these stations, in some cases, to deliver popular lectures on their sciences to the farmers of the neighborhood, thus carrying out the idea that was prominent at the time that the first station was established; and working as these men are all the time on problems in whose solution the farmer has a peculiar interest, there is no doubt that where these lectures are well given and well listened to, they may do much for the improvement of the farmer's practice; but it is not of this kind of education proceeding from the experiment station that I wish to speak now, but of the less direct and really wider influence, which may be just as active and potent, whether the men who are doing the work of the stations ever leave their workshops or not, to teach the farmers whose interests they are laboring to advance.

In 1876, the twenty-fifth anniversary of the establishment of the first station at Möckern, was celebrated at that place by a gathering of agricultural chemists and others interested, and the publication of a special volume of the *Versuchs-Stationen*, a journal now twenty-seven years old, and devoted exclusively to the work of the stations. Only to give the bare titles of the papers, more than 2,000 in number that have originated at these stations in the first twenty-five years of their existence, takes 145 pages of this volume; these papers treat of original researches on the atmosphere, water, and soil, in their relations to the growth of plants; the physiology of plants, embracing everything relating to the conditions of their growth; the diseases of plants and all the enemies that attack them; the chemical composition of all kinds of agricultural plants, and at different stages of growth; the chemical composition of manures of all kinds; experiments with manures of all kinds, and on all kinds of crops; the composition of the domestic animals and their secretions, including milk; the composition of fodders and foods; the preparation and preservation of fodder; the digestion and digestibility of fodders; the production of various kinds of animals in meat, milk, wool, &c.; silk culture, forestry, the manufacture of wine and beer, and sugar, milk, butter, and cheese, and analytical methods in agricultural chemistry.

Such had been the work of the stations up to that time six years; and with a hundred stations at work now, it can well be believed that a busy man hardly has time to keep track of all the progress made in this one department alone, even if all his study lies in that direction.

To the German or the French farmer a large part of this new material has been directly accessible, for many of these articles were published not in abstruse scientific journals but in the agricultural papers; and each Experiment Station has in many instances published its own special annual report of the work of the year, which was doubtless freely circulated in its own immediate neighborhood, just as the annual reports of our own stations in Connecticut, New Jersey, and elsewhere are widely circulated in their respective States.

Thus each station becomes, by its published work, an important educational force in its own neighborhood or province; even though but one farmer in ten, more enterprising and more eager for new information than his neighbors, may read these reports with any care, yet as surely as he gets anything good from them and uses it to improve his own practice his neighbors will find it out and profit by it. No farmer can hide his light under a bushel, but his works are like a candle set on a hill, and all around him can learn lessons from his good or ill success. Furthermore, all this mass of new material, the work of the investigators at the Experiment Stations, has furnished a motive and a basis for much writing of books on agriculture, in which the results of the agricultural researches made in different parts of the world are brought together in their proper connection with one another, the wheat is screened from the chaff, and the practical bearings more plainly set forth; and in such compilations much greater force can often be given to the lessons taught by the cumulative evidence of concordant results obtained at different stations.

Such excellent works as Johnson's "How Crops Grow," and "How Crops Feed," so good as to have been considered worthy of translation and publication in Germany, which seems like carrying coals to Newcastle, and Armsby's "Manual of Cattle Feeding" are based in the one case largely and in the other almost entirely on the results of Experiment-Station work, and neither would have been written but for that material at the disposal of the authors.

Of similar works in Germany and France there are many more; and from the number of them, and the new editions that are in some cases called for, it is evident that the books are read even more than in this country. Of the means for education in this manner, derived primarily from the Experiment Station, there is no lack in any country where advanced agriculture is practiced; the lack is rather in the zeal with which they are used by those for whose particular benefit all this work is done. Again, the agricultural press is getting to make use more and more of both the older and the fresher results of Experiment-Station work for the edification of its readers. Whose contributions are more eagerly sought for by our leading agricultural papers just now than those of Mr. Lawes, of England, the founder and steady supporter for more than thirty years of an experiment station, older and more productive of valuable practical results than any other station in the world? And what does he write about but the results, many of the greatest value, because they have been accumulating during so many years, of his own Experiment Station. He has the fortunate gift of writing well as well as of investigating well, which gives to his teachings double force. How ready these same papers are to give up whole columns at a time to the publication of a series of results obtained at one of our own Experiment Stations, even if it be nothing more than the chemical composition of a number of commercial fertilizers in the market—information that is useful enough in its way, but much less so than what might be furnished from such sources if the Stations were supplied with means for doing something else besides analyzing fertilizers.

It appears plain that the Agricultural Experiment Station is a permanent institution in every agricultural country of importance; that it has already in a comparatively short time given us great accessions to our knowledge of the principles of agriculture, and that there are many channels of communication between the stations and the community whose welfare their work should improve. Does the farmer need that all this costly work shall be done in his behalf, and does he realize his need? If not, then he will not be educated by it. There are farmers who neither know nor care to know of anything better than the ways their fathers have trod before them; they are to be found in all parts of the country, and in larger proportions where the general standard of education is low, or else occupying those broad acres in the West, slowly but surely growing less and less broad, where farming consists in nothing but plowing skin deep, sowing the seed and reaping the harvest; but it is not in such regions that the few experiment stations in this country are located. Connecticut, New Jersey, New York, and North Carolina are not tilled by ignorant farmers, and their soils respond liberally only to intelligent and liberal treatment. An observing resident of New England said to me the other day that the farms there are gradually passing into the hands of men who bring some degree of intelligence and thought to bear on their work, and that those who simply follow the old methods and care nothing for new ideas are forced either to give up and go off or else to fall in line with their more progressive neighbors; the progressive farmer, the man who is ready to study new ideas, and to put them in practice so far as his circumstances will allow, is getting the upper hand just in proportion as the soil becomes worn out and exhausted by the careless or senseless treatment; the progressive farmer is the hope of every country where agriculture demands intelligence, and he is now the hope of the greater part of our country.

No one would deny that every such farmer knows his need of the Experiment Station, and knows that he can reap advantage from it. He may not accept as gospel all that comes from there; he may be and often is quite skeptical as to the value of the results obtained with indoor water culture or pot culture and chemical analyses; he may even sometimes go so far as to indorse such an expression of opinion as this, coming from an agricultural paper published in Central New York; speaking of the plans for the organization of the new Experiment Station of that State, its editor says: "The farmers of the State will be satisfied with nothing short of an experimental farm managed by men with ears to hear their questions and capability and willingness to answer them in a practical way before the questioner's eyes on the farm; not a mere Station with a chemical laboratory where a few scientists with fat salaries can pursue their studies and amuse themselves with their visionary schemes and pet theories of farming, as valuable to the average farmer as to the man in the moon, and no more applicable to the broad acres of the Empire State than to the sunken valleys of that opaque body." The editor gives evidence in such remarks that he has a better knowledge of astronomy than of an Experiment Station; but still there are those, even in some sense progressive farmers, who will heartily approve such an effusion; fortunately for the State, however, as I happen to know, the newly appointed Director of the Station will not entirely exclude the chemist, who, everywhere else in the world where there is such an institution is looked upon as its mainstay; he is already in search of one, and means that he shall have a fair salary and a fair laboratory too. But let the progressive farmer be critical, and often even skeptical; he should be critical, or he would not be worthy to be called progressive; if only he is not satisfied with the things of the past, nor even with the things of the present, but is ever striving after something better than either, the Experiment Station can draw encouragement and support from him, and he will learn in turn from the Experiment Station itself, even if it has a "chemist on a fat salary" of a thousand or fifteen hundred dollars.

Webster defines an experiment to be "an act or operation designed to discover some unknown truth, principle, or effect, or to establish it when discovered;" and he goes on to say that it differs from observation, which is merely the attentive consideration of things as they exist in nature. An experiment requires that something shall be done to bring certain objects into certain new relations to each other; the result may be a positive or a negative one; there may be a new effect or there may not be one; but whether there is or not the result may be just as important for practical purposes. If by a long and careful series of experiments it is shown that nitrogen in the fertilizers applied to corn produces no increase in the crop that is proportionate to the expenditure, the result is an important one to agriculture, for it may save the farmer, who will put himself in the way to learn the lessons which the Experiment Station may teach him, from paying 15 to 50 cents a pound for that expensive ingredient of commercial manures, to be put on a crop that will give him no profitable return for his investment.

An agricultural experiment is made for the purpose of learning something new about the production of crops, or milk, or meat, or wool; but such experiments were made long before Experiment Stations were established. Our entire present system of agriculture is based as much on the result of experiments as the present science of chemistry, which is considered eminently as an experimental science; is built up on the results of experiments in the laboratory; our improved methods of culture, our improved varieties of grain, fruit, potatoes, roots, &c., represent the accumulated experience of many years, and of thousands of experimenters in all parts of the world; our present stage of agricultural development has been reached by laborious experimentation, and if we are to go any further, and develop any more, we must continue to experiment. The Agricultural Experiment Station is established, as its name implies, expressly for agricultural experimentation; it is simply a new force put at the disposal of the farmer, in the direct line of all the progress in his art which has hitherto been made; it is not a new way of making advance in agriculture, but a strengthening of the old way, by setting apart men who are trained in the art of experimenting, who can devote their whole time to the work, instead of merely such scanty leisure as comes to the farmer.

Much, if not most, of the experimenting that has been done outside of the special institutions created for the purpose, has been prompted by pecuniary motives. In this way new varieties of plants and breeds of animals have been developed, and new methods of manufacturing agricultural products. This kind of experimentation will go on and yield useful results as heretofore; but there is a vast quantity of work of a kind that gives no direct pecuniary return whatever to those who do it, whose results are of at least as great pecuniary importance to agriculture as when the work is done for its direct profits, and, because there is no pecuniary return, and the necessary expense is sometimes serious, few farmers are able to undertake such work. A few years ago, wishing particularly to test a question raised by interesting experiments at the Massachusetts Agricultural College as to the effect on the proportion of sugar in fruits produced by potash salts as a fertilizer, I proposed to the members of a large and intelligent horticultural society of my own State, that if they would conduct certain experiments of the kind, according to a common plan laid out by me, I would analyze, without charge, such fertilizers as they might wish to buy and test. Hardly one responded; but the excuse was, and I saw that it was a good one, that they had no time for the details of the experiment—to look after them themselves. Just when they should be giving their attention to these details, they were, crowded with work that must be done at the time. If farmers could experiment in the winter, when their fields are hardened by frost or buried in snow, they might find it a pleasant occupation for the leisure hours of that season; but all the burden of the care of field experiments comes just when the burden of regular work is greatest.

The case, in short, is just this, then: Agriculture cannot stand still any more than can any other practical art. It must share in the general spirit of progress that rules the age. This progress depends on continued experimentation—much of it of a difficult and expensive character. The Experiment Station is created and provided with men, means, and appliances especially adapted to the work. Without a public that is ready to appreciate and understand its results, to be educated by them, and to put them into practice, it has no use in being. There is such a public waiting to receive and wisely use these results—waiting and willing to be educated by the Experiment Station. If there is not, the idea of progress in agriculture is nothing but a dream: and these institutions, lacking the encouragement that is absolutely essential to their existence, would have ceased long ago to exist, instead of spreading far and wide from their birthplace in Germany, or, perhaps more truly, on the farm of Mr. Lawes, in England, and increasing steadily in numbers from the beginning.

In order that the Station shall educate, and the farmer be educated, a certain attitude of each toward the other is essential. There must be, in the first place, mutual respect and confidence. The workers at the Station must give due consideration to the experience of the workers at the plow—an experience that is by no means to count for nothing in its bearings on the Experiment Station results.

On the other hand, the farmers must give due weight to the accuracy which especially characterizes their methods as distinguished from the necessarily rougher methods of the field and the common barn, and the more accurate reasoning that can be based on such results. Take, for instance, the question whether plants can feed on the free nitrogen of the atmosphere. Some people argue that because there is such a great abundance of nitrogen in the atmosphere that bathes the plant through its whole life, and because some crops can somehow get nitrogen in abundance where others cannot, therefore certain plants, at least, if not all, can make direct use of the free nitrogen of the atmosphere. Two most careful sets of experiments, by investigators known all the world over for their skill, accuracy, and honesty, have shown very conclusively that when a plant is put where it can get only a limited quantity of combined nitrogen from the soil in which it grows, besides an unlimited quantity of free nitrogen supplied in a constant stream of washed air passing over it, it can use only the combined nitrogen, and can make no use of the free nitrogen. I am aware that another series of investigations appears to have given the opposite result; but those who are acquainted with the full history of this series are little inclined to have faith in its results. Furthermore, no less an authority than Mr. Lawes has shown, by chemical analysis of the soils of some of his experimental plots. at different periods extending over many years, that when any crops, even such as appear to get their nitrogen from the air, are not supplied with manure, the quantity of combined nitrogen in the soil is surely diminished. It has, moreover, been shown again and again that every arable soil contains a quantity of combined nitrogen many hundred times greater than what is supplied in a liberal dressing of manure, which, however, is so difficultly assimilable that ordinarily remunerative crops cannot be made on that nitrogen alone. Yet, in spite of all these well-established facts, there are those who write for the agricultural papers, in a style which leads one to suppose that they consider themselves fitted to be teachers of men who almost scout the idea that the plant should go anywhere else than to the atmosphere for its nitrogen. To the merely superficial observer, it seems most natural that the plant should feed on atmospheric nitrogen, no matter whether free or combined. This belief that it does is founded on *nothing whatever* but this superficial observation; but this kind of observation is far more likely to lead to error than to truth. A fair degree of confidence in the results of careful scientific work would lead some of these writers to place less reliance on what is only apparently so clear and plain to them, but is contrary to the results of scientific research.

In the second place, each party should seek to acquaint itself as fully as possible with whatever truth the other has learned, whether by experience or by experiment. In a paper recently read before the London Farmers' Club, Voelcker says: "It is absolutely necessary that in conducting agricultural experiments the experimenter himself should not merely be a good chemist, but must have also a fair and sound knowledge of farming operations, and have gained considerable insight into the requirements of practical agriculture. Such knowledge, you will agree with me, cannot be obtained from books or lectures, but by taking a personal interest in, and daily going through, the routine work of a well-conducted farm. I have no hesitation that the absence of this essential groundwork has frequently been the cause of the failure of many experiments, and of the misleading and contradictory results which you cannot but have observed in not a few of the published records of field trials."

I can say nothing more forcible on that side of the question, and on the other little need be said, for I think that the progressive farmer, whom alone we can expect to be directly educated through the instrumentality of the Experiment Station, is ready to consider whatever comes in his way from the Station. It might only be said, perhaps, that he should go a little more out of his way than he now does to study the work of the Stations. Let him study it as critically as he will, in the light of his own common sense and practical experience, but fairly and with all due allowances for the manifold difficulties of the work. These difficulties are often too lightly thought of. Concerning this point, Voelcker says in the paper just noticed: "An agricultural experiment, to be worth recording at all, is, as I hope to show in the course of this address, no easy matter. Indeed, I may say, without fear of contradiction, that I do not know of any kind of experimental inquiry more difficult in carrying out rationally and successfully." I could give quotations from the writings of all who have undertaken agricultural experimentation, whether in the field or in the barn, expressing the same decisive opinion. To him who undertakes only a single experiment on one or on many points it does not appear to be so difficult a matter; for he nearly always gets an answer, and a decided one, either positive or negative, to his question. But every one who is accustomed to trying experiments knows that the result of a single one is, till confirmed by repetition, entirely insufficient for the "establishment of a new truth, principle, or effect;" and as soon as one begins in accordance with scientific methods, the only methods by which trustworthy knowledge is to be gained, to repeat his experiments he falls in line with others who have followed this method, and pronounces it difficult. It needs only a few trials of confirmatory tests, with one answer to the question put in the experiment, yes; another, no; and a third neither yes nor no, to convince any man that the way of the agricultural experimenter is hard; nor does it, on the other hand, need many trials with three or four or more results confirming each other to give him that peculiar confidence in the knowledge gained which every scientific student feels in the soundness of a principle which he has once established by proper methods.

The agricultural Experiment Station originated in a desire of the farmers for a better acquaintance with the principles underlying their life-occupation; the rapid and wide extension of the system gives evidence that it has met a widely-felt want; its faithful and busy workers have already produced an abundance of material for the farmer to test in his practice; and if neither teacher nor pupil be too wise in his own conceit, and each is fully appreciative of the worth of the other's possessions in his own field of labor there need be no fear but that this peculiar institution will become in every land where it takes root and thrives a most efficient means of improving the success, and consequently the condition, of the agricultural community."

That it shall do so in this country is certainly the sincere wish of every one who hears me; that it will do so is, I am sure, an article of your faith, as it is of my own.

The CHAIRMAN. Before the reading of the next paper by Professor Atwater, I have a communication which is so appropriate to the admirable paper just read, that I desire it to be placed before the convention.

WASHINGTON, D. C., *January* 10, 1882.

The Hon. GEORGE B. LORING,
Commissioner of Agriculture:

SIR: We understand that it has long been a matter of regret to the enlightened friends of scientific agriculture in this country that the department over which you preside is not possessed of an adjunct which, in Europe, is deemed an indispensable auxiliary to agricultural industry in all its branches, whether that industry be considered in its national or in its local relations.

We refer to those "stations" which, in Germany, under the name of *Versuchs-Stationen*, and, in France, under the name of *Stationen-agronomiques*, have been established for the purpose of making analyses of soils, of water, of manures, and of provender for cattle, as also for the purpose of instituting experiments in the acclimation of trees, plants, and vegetables, in connection with researches which look to the prevention or cure of the special diseases to which the products of the vegetable kingdom are liable.

We believe that the first "experiment station," created in the interest of public economy, was established in Germany, at Möckern, near Leipsic, in the year 1851, but the number of such establishments has so largely increased that the agriculture of nearly every important district of Germany may now be said to have its "station" devoted to the prosecution of such researches as have for their object the promotion of the special agricultural interests which shall be found best adapted to the soil and climate of each region.

And you are aware that these "experiment stations" have proved so fruitful of beneficent results that a periodical publication, devoted exclusively to the report of the investigations and discoveries made under their auspices, has been supported in Germany since the year 1859, until, at length, it has become a recognized authority for agricultural chemists, for students of vegetable or animal physiology, and, indeed, for all persons desiring the latest scientific intelligence in matters pertaining to husbandry.

Understanding that you are desirous of establishing, in connection with the Agricultural Department at Washington, an "experiment station" similar to those which have been found so advantageous in Europe, we beg leave, respectfully, to invite your attention to a tract of land which we believe to be peculiarly eligible for the purposes in question, whether regard be had to convenience of access, to the quality of its soil, or to the configuration of its area.

We refer to the "Trinidad estate," situated on the northeast boundary of Washington, in the immediate vicinity of the Columbia Institution for Deaf Mutes, at Kendall Green, and comprising an extent of 152 acres, which are believed to be ample for a preliminary essay in this direction.

The estate belongs to the Columbian University, and is held in trust by that institution with a view to its sale or rent, that by the proceeds from such sale or rent it may give a new impulse to the scientific and technical instruction which will hereafter form a part of the curriculum, so soon as its new university buildings shall have been erected in this city.

The farm will be conveyed to the Agricultural Department, by sale or lease, on terms satisfactory to the government.

Believing that the proposition we make has a two-fold advantage, that of contributing directly to the wants of the Agricultural Department, and to the cause of scientific education in this city, we beg leave to invite for it your careful consideration.

All which is respectfully submitted on behalf of the Columbian University.

W. W. CORCORAN, *President.*

ROBERT C. FOX, *Secretary.*

This communication, which I have received from Mr. Corcoran, I propose to lay before the Speaker to be submitted to the House of Representatives; and I propose to send with it such papers as are read here before this convention, in order that Congress may understand, fully and thoroughly, what the whole business means. I have a paper in my possession which has been prepared by Mr. Saunders, superintendent of the horticultural division of the department, a very admirable document, which I shall inclose, and which, if we have time, shall ask Mr. Saunders to read. These papers were prepared before the opening of the convention, and have no relation whatever to it. They happen to come in properly, however, and I think appropriately. Professor Atwater will now read the paper upon co-operative experiments.

Professor ATWATER. I am very happy to know that the paper which I have to read, and the remarks that I have to make, come in the connection in which they do, for it certainly seems to me that it is in a measure, if not in continuation, and in accord with the statements of the admirable paper to which we have listened. The particular object of this paper is to invite the attention of this meeting to the usefulness of studying certain of the great problems of fertilization and plant growth by co-operative experiments; by experiments which shall be made at experimental stations and by the agricultural colleges; by intelligent, capable, and able farmers; and it gives me great pleasure to have an opportunity to read a paper on this occasion, from the fact that I see before me quite a considerable number of gentlemen representing those institutions, who have been engaged or are engaged in precisely the experiments to which I shall call their attention:

O-OPERATIVE EXPERIMENTING AS A MEANS OF STUDYING THE EFFECTS OF FERTILIZERS AND THE FEEDING CAPACITIES OF PLANTS.

By Prof. W. O. Atwater.

Farmers from Canada to Texas are spending millions upon millions of dollars every ear for guano, fish scrap, ammoniated superphosphates, nitrate of soda, and the like. stensibly, they are buying the fertilizers at from $20 to $100 per ton. Actually they e buying nitrogen at from 15 to 40 cents per pound. But need the farmer spend so uch for nitrogen? Or might he use more with profit? These are questions that no rofessor of agriculture can answer. Indeed, no chemist or botanist to-day can so uch as tell him how the different plants he cultivates stand related to nitrogen, for hat ones he must buy it, and what ones he may use in his rotation to gather it from ture's stores and furnish it to him without money and without price save the cost of llage.

The question of the nitrogen supply is only one of a great many whose solution is most urgently demanded. We must know how to feed our plants, or go without food ourselves. We need more light. Some must come from the laboratory and the greenhouse; some must be sought in the field.

Field experiments rationally planned, carefully carried out, faithfully reported, and interpreted with the aid of the most advanced science, will carry us far toward finding out many of these things which we so much want to know. If, along with these, we can have proper studies, chemical and physical, of the soils experimented upon, analyses of the plants produced, and in addition pot experiments whose conditions can be definitely known and controlled, and especially if we can work together, we may hope for the information we need.

Five years ago, while director of the Connecticut Agricultural Experiment Station, I suggested some field experiments with fertilizers to be carried out by farmers for the purpose of studying the needs of their soils and the best materials to supply them. The outgrowth of these, in the form of extended series of experiments during four successive seasons, has been stated briefly in the American Agriculturist, and, in more detail, in the reports of the Connecticut Board of Agriculture for 1877, 1878, 1879, and 1880. The experiments of 1881 have not yet been published in detail, but a few of the more important results will be given herewith.

With the sets of experimental fertilizers were sent blanks on which any who should choose were invited to send reports of their experiments. Nearly three hundred experiments have been reported. They come from colleges, experiment stations, and individual farmers in all the States east, and from some west of the Mississippi, and from several of the British provinces. The quality of the work as indicated by the reports is most gratifying.

The experiments have been of two classes. The first, which may be called general experiments, are of a simpler sort, and intended primarily for soil tests, involve the use of eight or more different kinds and mixtures of fertilizing materials containing nitrogen, phosphoric acid, and potash. The second class, the "special nitrogen experiments," have been of more complicated character, and have had for their object the study of the feeding capacities of some of our more common cultivated plants, with special reference to the nitrogen supply.

It is to these latter experiments that attention is especially invited here.

THE FEEDING CAPACITIES OF PLANTS.

The experiments we are discussing bring us face to face with one of the most important problems with which agricultural chemistry has to deal, and at the same time throw some new light upon it. I refer to what may, perhaps, be most properly called the feeding capacities of plants, their power of gathering their supplies of food from soil and air, and the effects of the artificial supply of different ingredients of plant-food upon their growth.

A vast deal of experience in the laboratory and in the field bears concurrent testimony to the fact, though we are still deplorably in the dark as to how or why it is so, that different kinds of plants have different capacities for making use of the stores of food that soil and air contain. Of the ingredients of plant-food in our soils, the most important, because the most costly, is nitrogen. Leguminous crops, like clover, do somehow or other gather a good supply of nitrogen where cereals, such as wheat, barley, rye, and oats would half starve for lack of it, and this in the face of the fact that leguminous plants contain a great deal of nitrogen, and cereals relatively little. Hence a heavy nitrogenous manuring may pay well for wheat and be in large part lost on clover.

NEED OF MORE INFORMATION.

Hitherto we have been compelled to rely mainly upon European investigations for our facts regarding the nutrition of plants and the action of manures. Our information is incomplete, and even the foremost teachers may give us wrong counsel.

Dr. J. B. Lawes, of Rothamsted, England, unquestionably the foremost field experimenter in the world, in writing, in 1873, to the treasurer of the Massachusetts Society for the Promotion of Agriculture, said: "The best possible manure for all graminaceous crops—wheat, barley, maize (corn), oats, sugar-cane, rice, and pasture grass—is a mixture of superphosphate and nitrate of soda. * * * Potash is generally found in sufficient quantities in soils, and the artificial supply is not required." In more than half of our experiments with corn, and in nearly all with potatoes, the crops have been materially aided by potash salts, and without potash in the fertilizer they have often failed. The mixture which Dr. Lawes regards as "the best possible manure" for corn was sometimes very useful and sometimes brought almost no return. The potash, which his experience in England led him to consider superfluous, was here, in many cases, the most necessary of all the fertilizing ingredients.

Several years ago the professor of agriculture of one of our leading agricultural colleges proposed a series of formulas for different crops. With the rest was one for corn, which, with a moderate proportion of potash and a small amount of phosphoric acid, supplied nitrogen at the rate of 64 pounds, and at a cost of over $15 per acre. Later, a well-known writer upon agricultural science has enthusiastically advocated the culture of corn with chemicals, recommending for the purpose, and using in an extensive series of experiments upon his own farm, a fertilizer which supplied nitrogen at the rate of 90 pounds, and at a cost of $18 to $20 per acre. Both of these gentlemen thus assumed that to raise corn successfully would require large and costly supplies of nitrogen. The question whether corn can gather its own nitrogen, like clover, or demands an artificial supply, like wheat, whether it is an "exhausting" or a "renovating" crop, has been much discussed. Upon its answer depends the success of corn-growing in our older States. The experiments referred to bear emphatic testimony upon this point. The corn has almost uniformly refused to respond to nitrogen in fertilizers, and persists in getting on well without any artificial supply. But it has been largely benefited by phosphoric acid, and often by potash. The formulas above, with their large and excessively expensive amounts of nitrogen, would, in nearly every case, have involved great waste of both fertilizer and money.

EXPERIMENTS UPON THE EFFECTS OF NITROGENOUS FERTILIZERS.

One of the ways in which co-operative field experiments may aid in the solution of these problems may be illustrated by citing some of the details of the series of experiments upon the effect of nitrogen in fertilizers which were referred to above, and which have been performed by a number of professors in agricultural colleges and practical farmers, with what seems to me with most gratifying success.

The specific questions to be studied may be stated thus:

1st. How do the plants experimented with get on with the "mineral" fertilizers, such as are supplied by superphosphates and potash salts?

2d. More especially, how do they respond to nitrogen when added, in different forms and amounts, to the mineral fertilizers?

3d. And, finally, what inferences may we draw as to the feeding capacities of the plants, their power to gather their food from soil and air, and the effects of different materials upon their growth, especial reference being made to the nitrogen supply?

To the systematic study of these questions a special "nitrogen experiment" was devised in 1878, and conducted by several gentlemen. Similar series were repeated in 1879, and with some variations in 1880 and 1881.

The idea was to compare the effects of mineral fertilizers (superphosphate and potash salts) alone, and the same with nitrogen in different amounts and forms. The plan is explained in the following extract from a circular sent to the experimenters:

The object of this experiment is to test the effects of nitrogenous fertilizers in different amounts and combinations upon the growth of the plant, and inferentially its capacity to gather its nitrogen from natural sources.

The fertilizers.—The ingredients and amounts are such as are used in ordinary practice, phosphoric acid and potash being supplied in about the proportions that occur in a corn crop of fifty or sixty bushels, and nitrogen in one-third, two-thirds, and full amount in same crop.

Forms of nitrogen.—The nitrogen is supplied as nitric acid in nitrate of soda; as ammonia in sulphate of ammonia, and as organic nitrogen in dried blood.

Quantities of nitrogen.—The nitrogen is supplied at the rate of twenty-four pounds per acre in "one-third ration"; forty-eight pounds per acre in "two-thirds ration"; and seventy-two pounds per acre in "full ration."

Arrangement of plots and fertilizers.—The ingredients are supplied as—

Partial fertilizers	Group I. Nos. 1—3. each by itself. Group II. Nos. 4—6. Two by two.	Thus testing the effects of ingredients separately, and capacity of soil.
Complete fertilizers	Group III. Nos. 7—9. Nitrogen as nitric acid in nitrate of soda. Group IV. Nos. 10—12. Nitrogen as ammonia in sulphate of ammonia. Group V. Nos. 13—15. Nitrogen as organic nitrogen in dried blood.	Nitrogen in one-third, two-thirds, full ration.

The fertilizers were supplied, in part at cost, and in part gratuitously, by the Mapes Formula and Peruvian Guano Company of New York. Especial thanks are due to Mr. C. V. Mapes, without whose interest and enthusiasm, as well as counsel and substantial help, the enterprise could not have succeeded as it has.

The full details of the experiments are to appear in a report of the United States Department of Agriculture. The tables herewith give an outline of results of some of the experiments of the last season and will serve as illustrations. The figures are, however, much condensed, and many interesting details are omitted.

TABLE I gives the results of several experiments with cotton, corn, and potatoes. The unfavorable weather which affected the majority of the experiments has reduced the yield materially in most of these. In several the effects of unevenness of soil are manifest; on some the supply of available plant food in the soil was evidently so great as to obscure the action of the fertilizers. Those of Mr. Newton with corn, and Mr. Manning with clover, show marked exceptions to what seems to be the common rule, that these crops are not greatly aided by nitrogenous fertilizers. Indeed, all illustrate forcibly our need of more experimenting.

TABLE II shows an experiment on an older and slightly different schedule. It is interesting both because of its sharply defined results and as an illustration of the excellent work ordinary farmers do in this line.

TABLE I. NITROGEN EXPERIMENTS, 1881.

I. PROF. W. C. STUBBS, Alabama Agricultural and Mechanical College, Auburn, Ala.
Soil—Worn-out pasture; level, upland, sandy, light, well-drained. *Subsoil*—Reddish yellow clay. *Weather*—Dry and unfavorable.

II. EDWARD HICKS, Old Westbury, N. Y.:
Soil—Level, sandy loam, light, dry. *Subsoil*—Yellow loam. *Previous crop*—Corn. *Weather*—Dry and unfavorable.

III. PROF. C. L. INGERSOLL, Purdue University, La Fayette, Ind.:
Soil—Upland, level, black, similar to prairie, sticky when wet, bakes when dry; dry, well drained. *Subsoil*—Gravel. *Previous crop*—Corn. *Weather*—Very dry and unfavorable.

IV PROF. SAMUEL JOHNSON, Michigan Agricultural College, Lansing, Mich.:
Soil—Level, upland, sandy loam, light, drained dry. *Subsoil*—Gravelly. *Previous crop*—Corn. *Weather*—Dry, cold, unfavorable.

V. W. C. NEWTON, Durham, Conn.:
Soil—Old meadow, hill land, dark loam. *Subsoil*—Moist. *Weather*—Unfavorable.

VI. J. W. PIERCE, West Millbury, Mass.:
Soil—Worn out grass land, upland, nearly level, clay loam, light, dry. *Subsoil*—Gravelly, but some clay. *Weather*—Cold and unfavorable.

VII. C. E. THORNE, farm manager, Ohio State University, Columbus, Ohio:
Soil—Level, upland, clayey loam, "drift formation" from Huron shale, compact, wet before draining. *Subsoil*—Similar to surface soil, retentive. *Previous crop*—Corn, with stable manure. *Weather*—Severe drouth.

VIII. J. M. MANNING, Taunton, Mass.:
Soil—Upland, sandy loam, loose. *Subsoil*—Yellow sand. *Previous crops*—Potatoes and corn. *Weather*—Unfavorable.

TABLE I.—EFFECTS OF NITROGENOUS FERTILIZERS.

I. Professor STUBBS, Alabama, COTTON.
II. Mr. HICKS, New York, CORN.
III. Professor INGERSOLL, Indiana, CORN.
IV. Professor JOHNSON, Michigan, CORN.
V. Mr. NEWTON, Connecticut, CORN.
VI. Mr. PIERCE, Massachusetts, CORN.
VII. Mr. THORNE, Ohio, CORN.
VIII. Mr. MANNING, Massachusetts, CLOVER.

Fertilizers and produce per acre.

	Number of experiment.		I. Cotton.	II. Corn.	III. Corn.	IV. Corn.	V. Corn.	VI. Corn.	VII. Corn.	VIII. Clover.
			Lbs.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Lbs.*
	0.	No manure	587	16.3	38.2	44.7	12.5	10.3	40.0	480
Preliminary Group	1.	Nitrate of soda, 150 pounds	805	26.0	35.9	58.1	22.5	11.7	44.8	700
	2.	Superphosphate, 300 pounds	1,162	22.8	36.4	51.2	13.8	16.0	48.6	1,200
	3.	Muriate of potash, 150 pounds	564	34.5	34.5	52.0	15.0	17.7	48.6	940
	4.	Nitrate of soda, 150 pounds Superphosphate, 300 pounds	1,599	24.5	33.6	61.6	23.8	14.8	50.3	1,080
	5.	Nitrate of soda, 150 pounds Muriate of potash, 150 pounds	932	29.5	34.5	43.6	23.8	23.0	44.9	560
	6.	Superphosphte, 300 pounds Muriate potash, 150 pounds } mixed mineral fertilizers.	1,219	28.2	34.5	59.0	13.8	34.6	52.	1,140
Nitrate of soda Group	7.	Mixed mineral fertilizers (as No. 6) Nitrate of soda, 150 pounds	1,541	29.0	37.3	58.8	23.3	34.0	49.1	1,200
	8.	Mixed mineral fertilizers Nitrate of soda, 300 pounds	1,404	33.8	32.5	55.6	41.7	35.7	45.7	1,460
	9.	Mixed mineral fertilizers Nitrate of soda, 450 pounds	1,242	31.5	33.1	49.1	56.7	41.4	47.4	1,480
	6*a*.	Mixed mineral fertilizers (as No. 6)	8,115	30.0	33.4	56.7	16.3	37.7	46.0	1,060
Sulphate of ammonia Group	10.	Mixed mineral fertilizers Sulphate of ammonia	1,116	27.8	36.1	55.7	28.5	39.4	41.7	1,880
	11.	Mixed mineral fertilizers Sulphate of ammonia	1,265	30.8	38.4	58.9	42.5	40.3	42.3	2,000
	12.	Mixed mineral fertilizers Sulphate of ammonia	1,162	32.5	34.0	50.4	48.3	39.4	43.4	2,400
	6*b*.	Mixed mineral fertilizers (as No. 6)	....	29.0	35.7	51.0	....	28.6	48.3	1,440
Dried blood Group	13.	Mixed mineral fertilizers Dried blood, 225 pounds	1,357	37.6	34.0	49.4	28.8	35.4	41.1	1,620
	14.	Mixed mineral fertilizers Dried blood, 450 pounds	1,300	36.3	34.5	51.6	33.8	37.0	41.4	1,940
	15.	Mixed minerals (as No. 6) Dried blood, 675 pounds	1,127	35.2	33.4	61.4	40.6	39.0	39.4	2,420
	6*c*.	Mixed minerals (as No. 6)	....	30.7	33.4	57.1	20.6	....	40.9	1,200
	16.	Farm manure	....	....	....	....	....	....	48.7	1,500
	00.	No manure	449	16.5	33.1	31.7	13.8	....	35.4	800

In Professor Stubb's experiment three plots, not mentioned in the table, had "mixed minerals" with cotton-seed meal in quantities to supply nitrogen in the same amounts as in the nitrate of soda, sulphate of ammonia, &c. The yields were, with ⅓ ration 1,252.5 pounds, with ⅔ ration 1,518 pounds, and with full ration, 1,345 pounds per acre.

TABLE II.—EFFECTS OF NITROGENOUS FERTILIZERS.

Experiments with oats and potatoes in 1881. By Mr. Charles Fairchild, of Middletown, Conn.

[Soil, dark loam, loam subsoil, moist; had oats in 1877, rye in 1878, grass in 1879, and corn fertilized as below in 1880.]

	Kind and amount of fertilizers per acre.	Yield per acre.			Increase per acre.			Cost of fertilizers, freight, &c.	Pecuniary results.			
		Oats.		Potatoes.	Oats.		Potatoes.		Value of increase.		Gain.	
		Grain.	Straw.		Grain.	Straw.			Oats.	Potatoes.	Oats.	Potatoes.
		Bush.	*Lbs.*	*Bush.*	*Bush.*	*Lbs.*	*Bush.*					
0	No manure	26.9	1,180	28.0								
1	Nitrogen mixture, 150 pounds	38.1	1,820	42.0	11.3	627	13.3	$6 00	$9 75	$9 98	$3 95	$3 98
2	Superphosphate, 300 pounds	33.8	1,800	56.0	6.9	607	27.3	6 00	7 42	20 48	1 42	14 48
3	Muriate of potash, 150 pounds	31.3	1,720	60.0	4.4	527	31.3	3 75	5 50	23 48	1 75	19 73
4	Nitrogen mixture, 150 pounds, and superphosphate, 300 pounds	51.9	2,660	94.7	25.0	1,467	66.0	12 00	22 55	49 50	10 55	37 50
5	Nitrogen mixture, 150 pounds, and muriate of potash, 150 pounds	42.5	2,160	68.0	15.6	967	39.3	9 75	14 40	29 48	4 65	19 73
6	Superphosphate, 300 pounds, and mur. of pot., 150 pounds, "mixed minerals"	33.8	2,280	90.7	6.9	1,087	62.0	9 75	10 30	46 50	55	36 75
7	Mixed minerals (as No. 6), 450 pounds, and nitrate of soda, 150 pounds	54.4	3,500	124.7	27.5	2,307	96.0	15 75	28 97	72 00	13 22	54 25
8	Mixed minerals, 450 pounds, and nitrate of soda, 300 pounds	59.4	3,860	138.7	32.5	2,667	110.0	21 75	33 88	82 50	12 13	60 75
9	Mixed minerals, 450 pounds, and nitrate of soda, 450 pounds	59.4	4,300	120.0	32.5	3,107	91.3	27 75	36 52	68 40	8 77	40 65
6a	Mixed minerals (as No. 6), 450 pounds	36.3	1,760	94.0	9.4	567	65.3	9 75	8 56	48 98	1 19	39 23
00	No manure	27.5	1,280	46.7								
10	Mixed minerals, 450 pounds, and nitrogen mixture, 150 pounds	51.9	3,140	122.7	25.0	1,947	94.0	15 75	25 43	70 50	9 68	54 75
11	Mixed minerals, 450 pounds, and nitrogen mixture, 300 pounds	55.6	3,380	144.7	28.8	2,187	116.0	21 75	28 93	87 00	7 10	65 25
12	Mixed minerals, 450 pounds, and nitrogen mixture, 450 pounds	59.4	3,780	144.7	32.5	2,587	116.0	27 75	33 40	87 00	5 65	59 25
6b	Mixed minerals (as No. 6), 450 pounds	33.8	1,760	110.0	6.9	567	81.3	9 75	7 18	60 98	2 57	51 23
13	Mixed minerals, 450 pounds, and sulphate of ammonia, 225 pounds	61.9	3,700	135.3	35.0	2,507	106.6	21 75	34 29	79 95	12 54	58 20
14	Mixed minerals, 450 pounds, and dried blood, 450 pounds	53.8	3,080	134.7	26.9	1,887	106.0	21 75	26 10	79 50	4 35	57 75
15	Peruvian guano, 450 pounds, and muriate of potash, 150 pounds	54.4	2,980	133.3	27.5	1,787	104.6	21 75	25 85	78 45	4 10	56 70
16	Mixed minerals (as No. 6), 450 pounds	35.0	1,760	96.0	8.1	567	67.3	9 75	7 87	50 48	1 88	40 73
000	No manure	26.3	1,120	29.3								
A	Bone, 150 pounds	31.3	1,680	54.0	4.4	487	25.3	3 00	5 33	18 98	2 33	15 98
B	Bone, 150 pounds, and muriate of potash, 100 pounds	35.0	1,960	74.0	8.1	767	45.3	5 50	9 07	33 98	4 57	28 48
C	Same as B, and sulphate of ammonia, 100 pounds	45.6	1,980	....	18.8	787	....	10 75	15 03	....	4 28	....

The plots were parallel strips of eight square rods each. In 1880 corn was planted over the whole field. In 1881 the whole was divided into halves by a line crossing the plots, and one-half devoted to oats and the other half to potatoes. Mr. Fairchild proposes to follow with wheat and grass, thus running the experiment through a regular rotation of several years, the same fertilizers being applied to the same plots year after year, while the crops succeed each other, as in ordinary farm practice. The cost of the fertilizers includes $5 per ton for freight and applying. Potatoes are estimated at 75 cents per bushel, oats at 55 cents, and oat straw at $12 per ton, which are fair rates for the region and season.

The variety of results in the different experiments is very striking. Mr. W. I. Bartholomew, of Putnam, Conn., has been conducting the nitrogen experiments with corn and potatoes for three years. In every trial every plot which has received phosphoric acid has given a more or less satisfactory return, and every one without phosphoric acid has failed. Nitrogen and potash have each increased the yield of corn, but neither has brought enough increase to pay its cost, and the loss has been larger or smaller as more or less was used. Potatoes, on the other hand, have responded profitably to all the ingredients.

Mr. C. Sage, of Middletown, Conn., has had a very different experience. Nitrogen has proved as inefficient on his land as on Mr. Bartholomew's. Phosphoric acid, which Mr. Bartholomew finds so effective, helps him but little, while potash is decidedly the regulating ingredient, the corn responding uniformly and largely to every application of potash salt. One hundred and fifty pounds per acre of muriate of potash, costing $3.50, makes the difference between corn so poor as to be hardly worth the husking, and 60 bushels or more of beautiful shelled corn and a fine growth of stalks.

In the experiment of Mr. G. Newton, of Durham, Conn., given in Table I, we have a still different result. Potash is as useless as in Mr. Bartholomew's experiments. Phosphoric acid does no more good here than with Mr. Sage. But the nitrogen to which both these gentlemen's corn paid so little heed is on Mr. Newton's soil uniformly efficient. The corn responds largely and profitably to nitrogen in every form and on every plot, and the yield rises and falls regularly with the amount of nitrogen applied; I should add that in each of these cases the results are those not of a single, but of two or three years' trials. Mr. Newton's experience, however, seems to be an exception and an unusual one. Instances in which the nitrogen is absolutely harmful are much more frequent. Professor Thorne's in Table I is such an one. The corn here suffered from very severe drought, but Professor Thorne writes me that he has observed the same thing in favorable seasons, and several other reports tell the same story. Mr. J. W. Sanborn, the well-known farm superintendent and experimenter at the New Hampshire Agricultural College, has a case in which sulphate of ammonia helped the corn materially the first season, did no good the second, and "utterly demoralized" it the third.

On soils that are rich, or even in fairly good condition, nitrogenous fertilizers, like other manures, often show very little effect. Such seems to be the case in Professor Henry's experiment in Table I.

EFFECTS OF NITROGENOUS FERTILIZERS UPON CORN.

Estimating a bushel of corn, with its cobs and stalks, to contain 1¼ of nitrogen, and to be worth 80 cents, the effects of the nitrogenous fertilizers in the special and in the general experiments may be summarized as follows, remembering that the superphosphate and potash salt, "mixed minerals," supplied the amounts of phosphoric acid and potash in a crop of not far from 55 or 60 bushels, which would also contain about the 72 pounds of nitrogen

In the general experiments of the mixture of 300 pounds superphosphate and [illegible] pounds muriate of potash brought on the average of fifty-three experiments, about 43½ bushels of shelled corn per acre. The special experiments, however, seem to me a fairer test of what the fertilizers may do, because, while made in all sorts of weather and on worn-out soils, they were nearly all on soils and in latitudes fit for corn, as many of the general experiments were not. In these the mixture of 300 pounds superphosphate and 150 pounds of potash salt, which can be bought for $8.25, brought, on the average, 43 bushels of shelled corn per acre. Omitting Mr. Newton's experiment, the results of which are very exceptional, the average is 44½ bushels.

The experiments of the four seasons bear almost unanimous testimony to two things: The corn was helped but little by nitrogen in the fertilizers; and it gathered a good deal from natural sources. The increase of crop and of nitrogen in the crop will appear more clearly if we look at it another way.

In number of trials—	With nitrogen.		The average increase of corn was—	The increase of nitrogen in the crop was.
	Amount per acre.	Contained in crop of—		
	Pounds.	*Bushels.*	*Bushels.*	*Pounds.*
95	24	18	3.6	4.8
76	48	36	5.3	7.1
42	72	54	6.6	8.8

Or, estimating the results in dollars and cents:

In trials, total number.	With nitrogen, amounts.	Costing.	The nitrogen paid for itself in trials.	The nitrogen failed to pay for itself in trials.	The average loss in the several trials was.
95	24 lbs.	$5 50	21	74	$2 62
76	48 lbs.	11 00	13	63	6 76
42	72 lbs.	16 50	4	38	11 22

The only cases in which the largest rations were profitable were in the experiments of Mr. Newton.

The above calculations of pecuniary loss and gain of course apply only to those regions where corn is dear. But even at these rates the nitrogen increased the crop enough to pay its costs in only 38 trials out of 213. The pecuniary loss rose and fell with the amount of nitrogen used. With mineral fertilizers alone the crop gathered, by the above estimates, some 60 pounds of nitrogen per acre.

The important fact, however, is this: The corn plant has in these trials shown itself capable of getting on and bringing fair yields with small amounts of the less costly mineral fertilizers, even in the worn-out soils of the Eastern States. With this help it has gathered its nitrogen from natural sources, and holds it readily to be fed out on the farm and returned in the form of manure for other crops. In other words, the experiments thus far imply that corn has, somehow or other, the power to gather a great deal of nitrogen from soil or air, or both; that in this respect it comes nearer to the legumes than the cereals; that, in short, corn may be classed with the "renovating" crops. If this is really so, and this can be settled only by continued experimenting, then our great cereal, instead of being simply a consumer of the fertility of our soils, may be used as agent for their restoration.

FEEDING CAPACITIES OF OTHER CROPS.

The results of the experiments with other crops were briefly summarized in an account given in the last report of the Connecticut board of agriculture, as follows:

"Taking all in all, the potatoes responded well to the superphosphate, the potash salt, and the nitrogenous fertilizers, and the 'complete fertilizer' has been most profitable in almost every case where the weather permitted fair growth. None of the other crops, except, perhaps, turnips, have shown such uniformly beneficial results from all the materials.

"The experiments indicate very decidedly that the potato plant differs from many others in respect to the effect of these fertilizing materials upon its growth, and imply that it has less capacity than corn for gathering an adequate supply of food from natural sources. It seems to demand a full and immediately available supply of nourishment for its successful growth.

"Concerning the other crops, the data at hand are too meager to warrant any general conclusions. * * * In general, however, the experiments accord with the common notion that makes superphosphate almost a specific for turnips. But they imply that even when the superphosphate is supplied in abundance, the turnip is not usually able to gather enough of the other materials for a full yield unless they are close at hand in readily available forms."

EXPERIMENTS WITH COTTON.

Professor Stubbs' experiment with cotton is extremely interesting. Phosphoric acid has great, and potash very little, effect. Nitrogen increases the crop, but that in cotton-seed meal is as useful, or more so, than in the other and more costly materials, nitrate of soda, sulphate of ammonia, and dried blood. This is only one of a number of experiments which Professor Stubbs has made, upon whose results, added to his general experience, he bases a number of important conclusions, among which are the following:

"1. Our [Alabama] soils, which result from the disintegration of metamorphic rocks, principally feldspathic and hornblendic, need a little nitrogen, much phosphoric acid, and no potash for cotton.

"2. Our great want, and it seems to prevail through the older cotton States (except the black cretaceous belt of Alabama, which has not been thoroughly tested), is soluble phosphoric acid. On worn-out soils a small amount of nitrogen is required. A fertilizer with 3 per cent. of nitrogen and 10 per cent. of soluble phosphoric acid, meets the demand very well.

"3. Phosphoric acid hastens and nitrogen retards the maturity of the crop.

"4. Cotton seed and cotton-seed meal are as effective as dried blood, sulphate of ammonia, nitrate of soda, or other nitrogenous fertilizers, and far cheaper and more economical."

To what extent and under what conditions such principles as these are applicable in the culture of cotton and other crops, are matters of vital importance in Southern agriculture. The usefulness of systematic experiments to test them needs no argument.

EFFECTS OF PHOSPHORIC ACID IN DIFFERENT FORMS OF COMBINATION.

The nitrogen supply is only one of the many questions whose solution is of vital importance to our agriculture. The relations of phosphoric acid, potash, and other ingredients of plant food, whose lack in our soils we seek to supply, at great expense, with phosphates and potash salts, demand equally full and thorough study.

Treating the insoluble phosphate of bone or mineral phosphate with acid to make superphosphate is expensive. Soluble phosphoric acid costs us from 12 to 15 cents or more per pound, while we can buy it in the insoluble forms for from 4 to 6 or 7 cents. The general theory is that superphosphate is necessary, but still, somehow or other, many of us have the feeling that, in many cases at least, the cheaper insoluble phosphates would do as well; that fine grinding might serve instead of superphosphating; and that there are many cases in which the cheap rock phosphates might replace the dearer bone manure. If so, the saving would be immense.

The Aberdeenshire Agricultural Association of Scotland, through Mr. Thomas Jamieson, F. C. S., its chemist, has been for several years past conducting an extended system of experiments in which have been studied, with other things, the effects of phosphoric fertilizers of different sorts, alone and associated with nitrogen.

The results of several years' work on five typical varieties of Aberdeen soil in the ordinary state of cultivation are summarized by Mr. Jamieson in the statements.

"1. That phosphates of lime decidedly increase the turnip crop, but that farmers need not trouble themselves to know whether they are of animal or mineral origin.

"2. That soluble phosphate is not superior to insoluble phosphate to the extent that is generally supposed.

"3. That nitrogenous manures have little effect on turnips used alone, but when used with insoluble phosphates increase the crop; that the addition of nitrogen to soluble phosphates does not seem to increase the solid or dry matter in the crop; that there is no material difference between the effects of equal quantities of nitrogen in nitrate of soda and in sulphate of ammonia.

"4. That fineness of division seems nearly as effective in assisting the braird and increasing the crop as the addition of nitrogenous manures. Hence the most economical phosphoric manure for turnips is probably insoluble phosphate of lime, from any source, ground down to an impalpable powder."

Mr. G. Clendon, jr., of Buckner's Station, Va., who has carried out a series of the "general" experiments above referred to, and taken the opportunity to test finely-ground South Carolina phosphate alongside the dissolved bone-black, obtained with the raw phosphate a yield larger than with superphosphate or stable manure, and nearly as large as with the complete fertilizer. The testimony of a single experiment, of course, must always be questioned; but Mr. Clendon's results have the regularity that characterizes uniform land, and seem to be borne out by other experiments and his general experience. He writes:

"My experiments have been carried on over ten years. In every year the good effect of the raw phosphate was apparent. * * * The soil is a decomposed gneiss, uniformly poor, and is a fair sample of hundreds of square miles lying between the base of the Blue Ridge and tide-water in Virginia. * * * I think the experiments should be repeated over a wider country."

On the other hand, it is a familiar fact that in the neighborhood of Charleston, S. C., where the raw phosphate is obtained, its use in the raw state has not become general, and that many attempts elsewhere to introduce insoluble phosphates have failed. When, where, and why the different forms of phosphoric acid are in place, are problems that demand thorough investigation.

WHAT IS NEEDED FOR SUCCESSFUL FIELD EXPERIMENTING.

Unless I greatly err, one of the chief causes of the failure of so much of the honest and thorough field experimenting that has been done, to accomplish its purpose has been that the questions have been too complex, while the work has not been prosecuted far enough to make it all complete.

It is by selecting specific and narrow questions, and working at them systematically and continuously, that we shall secure the most valuable results. There has been too much firing at random. We need to choose proper points of attack be sure of our aim and concentrate our fire until a breach is made.

CO-OPERATIVE EXPERIMENTING.

And we need not only to work rightly, but to work together. Experiments with a common object on a common plan, conducted by intelligent, careful investigators, in different places, under different but accurately observed and recorded conditions, are needed to bring the results which scientific agriculture so pressingly demands.

A letter from Professor Henry, of the agricultural department of the University of Wisconsin, says most aptly, "What we most need is *union*," and dwells upon the importance of co-operative field experiments with fertilizers, experiments which shall be "*far-reaching*" in their character.

Mr. Sanborn, of the New Hampshire Agricultural College, in alluding to the fact that most of our agricultural science hitherto has come from Europe, and that we need facts and principles of our own, says of the work of field experimenting with fertilizers: "It is of incalculable importance to the country," and adds: "The co-operative plan is the only right thing if quick and reliable work is to be done." And unless I greatly err, these gentlemen, who, with numerous others, are showing their faith by their works, are expressing in the words just quoted a general sentiment of the men who today are doing most to promote agricultural science in this country.

Now it seems to me that the way to co-operate is to co-operate. The way to get on is to "stay not upon the order of your going, but go." Go wisely, carefully, rationally, slowly, if need—but go.

The colleges and experiment stations of nine States, and several prominent farmers of the same and other States, have already commenced work on the schedule above explained. Six other colleges and stations have made arrangements to commence the same experiments this season, and three others are experimenting on the same question of the effects of nitrogenous fertilizers, though on somewhat different plans.

Several State agricultural reports show that the same enterprise is being considered by other official bodies as well. The secretary of the Ohio Board of Agriculture, Mr. Chamberlain, in his last report devotes a number of pages to accounts of the nitrogen experiments referred to, and suggests the study of the nitrogen supply for wheat on typical soils in his State. The last report of the commissioner of agriculture of Virginia recommends similar experiments in that State. Several other State organizations are taking steps in the same direction. Besides all these, there are numbers of intelligent farmers throughout the whole country who are able and will be more than willing to contribute most efficient work. The experiments above cited suffice to prove this beyond all doubt.

With the assured co-operation of so many representative men, including really the majority of the best known experimenters in the country, the feasibility of co-operative experimenting is no longer a question.

At the conclusion of Mr. Atwater's paper the chair submitted the question of the experimental stations to the convention for discussion, previous to which he read the following paper from Mr. William Saunders:

The work of experiment stations consists chiefly in investigations and experiments directly or indirectly connected with the nutrition and growth of animals and plants useful in agriculture. Various branches of agricultural technology, and the testing of the quality and value of commercial fertilizers, food materials, and seeds, are also objects of their labors. It is related that of the 40 German stations in operation during the year 1874, 13 were engaged in researches in animal physiology; 20 in vegetable physiology; 5 were busied chiefly with studies in the chemistry and physics of the soil; 4 made a specialty of grape culture and wine production, and 5 of questions in agricultural technology. Besides the work above mentioned, a control of the trade in fertilizers, by analyses of wares bought and sold, was exercised by 28, of that in seeds by 16, and of that in fodder materials by 13 stations.

The care and patience and thoroughness with which these experiments are conducted, the amount of labor and time and money they cost, and the ways by which their results are applied, would be quite astonishing to those unacquainted with these details. A single experiment often requires the hard and unremitting work of several chemists day and night for several weeks or months.

The experiments thus described are numbered by hundreds and even thousands, each one of which has cost the labor of days, weeks, or months. They have called in requisition the services of the ablest scientific men and the most successful farmers. They have involved an incalculable amount of thought, care, and toil in the laboratory, the stable, and the study. Nor has the work been in vain. These investigations have done a vast deal to settle the questions about stock feeding, which are as perplexing as they are important to millions of farmers on both sides of the Atlantic. Combined with the results of daily farm experience, they have shown for what purposes different kinds of fodder materials are best fitted, and how much each is worth. They have taught the farmers how to make valuable fodder out of poor hay and straw; how to employ lucern, clover, and other forage crops to the best advantage; how to utilize waste products, such as flax-seed and cotton-seed and the oil-cake, made from them; also the refuse from the manufacture of sugar from beets, and of alcoholic spirits, and starch from potatoes and grains. They have shown in what proportions these and much of other fodder materials should be mixed and used so as to get the greatest benefit at the least cost, thus supplying farmers with just the information they need in order to keep their stock and produce, meat, dairy products, and whatever else comes from the maintaining of domestic animals, most rationally and with the largest profit. * * *

There is certainly no agricultural country in the world where experimental stations, wisely conducted, can be made of so much direct practical benefit to every tiller of the soil, and consequently to the increase of national wealth, as in these United States; and while we may profit by studying the methods which have been found valuable in the conduction of experiment stations in Europe, as we already have profited (in common with the civilized world) from their magnificent results, our special requirements suggest a wider range of co-operative action in fields which promise practical results equally important and more immediately available in their application than those emanating from the laboratory alone; although chemical analysis is the indispensable factor in all things relating to exact science, yet there are many questions of vast importance to the cultivator of the soil which can only be answered by careful comparison and observation in the fields.

To begin with, the Department of Agriculture should have at its disposal for occupancy a farm of 150 or 200 acres in the District of Columbia, where, in addition to other purposes to be noted further on, space would be secured sufficient to plant a fruit orchard which should contain one specimen of every variety of fruit tree and bush suited to the climate, with provision for adding to the collection all new fruiting plants that may be introduced from time to time, for the purpose of assisting towards a uniform and correct nomenclature, for obtaining a knowledge of their respective values, and for the careful notification of everything valuable which could be obtained by the possession of such a collection.

Then at carefully selected stations in different parts of the country (particularly on account of distinctiveness of climates), establish experiment farms, not exceeding 100 acres in extent each, which amount of land would be amply sufficient for all practical experiments in the line of plants and crops of all kinds, at least at the outset. These farms to be of average good soil in their respective localities, well supplied with water, so that a portion of the land could be employed for experiments in the irrigation of certain crops at certain seasons, and otherwise embracing a fair representation of the particular topographical features of the country contiguous to the location. Suitable accommodations should be provided for the working animals, also offices for the superintendent, and such other officers as might be employed, temporary or otherwise, so that the entomologist, the chemist, the microscopist, the botanist, and others, would here find a place for such work as might be found necessary in their respective duties in connection with the station.

It would, of course, be impossible to enumerate with any degree of accuracy *all* the work which may be performed at or by these stations. As work progressed suggestions would constantly offer themselves in furtherance of the various processes on hand. Some leading objects, however, may be noted.

1. To ascertain, by comparative growth in certain locations, the exact value of the most popular varieties of our cultivated staple plants, with a view to assigning to each its proper isothermal line of pre-eminence. For example, there are numerous varieties of the cotton-plant in cultivation, each one of which has its peculiarities more or l distinctly marked, some producing a short fiber, others a longer, some robust in growt and of great hardihood in regard to ungenial seasons, others the reverse of this, b producing valuable lint, and so on indefinitely. Nothing can well be of more imp tance to that industry than to possess a thorough knowledge of the exact value o each variety, so as to be enabled to place each kind in the district where it wo prove to be best adapted. In this way many varieties would probably be discarde and their places supplied by others which have shown themselves to be more worth in every qualification. This knowledge would also be preliminary to the further i provement of the cotton-plant, by crossing varieties, or, it may be, by hybridizi species. This line of improvement is of the greatest importance; certainly no oth method of improving either vegetables or animals can lay claim to any approach scientific accuracy or exactness; and what can be done with the cotton-plant can al be done with tobacco, sorghum, beets, wheat, corn, and in short with all fruits, cerea and vegetable esculents in cultivation throughout the country.

2. To ascertain to what extent crops may be improved by a more change of see from one climate to another. There are no settled facts bearing upon this point; at events there are none that are recognized as being beyond dispute, but it is, neverth

less, well-known that seeds acquire habits of earliness, lateness, and other peculiarities, according to the climates and conditions of their growth. A series of carefully arranged tests, made through the interchange of seeds from one climate and position to other climates and localities, would undoubtedly be the means by which questions of this character can be properly worked out.

3. *Rotative cropping.*—The advantages of a rotation of crops are sufficiently established, but the exact, or even the approximate rotative value of each plant, is very obscure. For example, it has been stated that strawberries will succeed better when they follow a potato crop than they will otherwise do, and that the tomato will similarly show the advantages it gains by following a crop of melons. Whether these and other claimed peculiarities have any foundation in fact, and if so, how much is dependent upon the mechanical effects of culture, chemical exhaustion, or other causes, opens up an unexplored field of inquiry which will reward serious prosecution.

4. *Value of fertilizers.*—This is a subject which requires but little explanation. The exact specific relations that exist between plant life and plant food is but imperfectly understood, and is in itself an all-important object of experiment.

5. Most of our cultivated races of plants have run into numerous varieties, many of them comparatively worthless. A test of their exact merits, with the result of discarding those of inferior merit, would be the means of throwing from seed lists and plant catalogues many worthless things.

6. There is a pressing necessity for increased facilities for the propagation of new plants, especially of those known as semi-tropical, such as the cinchona, orange, olive, tea, &c., and even some which may be classed as tropical, such as the pine-apple, banana, ginger, coffee, &c. There are sections of the country where the climate will admit of the propagation of all such plants in the field. A station or farm in such a locality would enable the department to furnish plants which would vastly assist the increase of these and similar industries.

7. The organic law creating the department charges it with the following duty: "To test by cultivation the value of such seeds and plants as may require such tests, to propagate such as may be worthy of propagation, and to distribute them among agriculturists." To discharge this duty makes it imperative that land should be occupied by the department in various climates and sections of the States.

These indicate the nature of the work which can be accomplished at experimental farms.

Mr. ALVORD addressed the convention, giving it as his opinion, that the best method of arriving at the results suggested in the papers of Professors Caldwell and Atwater would be to arrive at some form of co-operation between the colleges and private enterprise. The most important problem is how to prevent unintentional duplication of work.

Mr. McBRIDE offered the following preamble and resolution:

Whereas, the following statements are not to be denied:

1st. That scientific investigation is as much a part of the duty of the agricultural college as teaching.

2d. That many of the most important questions connected with agricultural science are as yet unsettled—many of its principles not formulated.

3d. That these cannot be determined from the data afforded by a few isolated experiments limited in time, season, and locality, but only from those of long-continued series fairly representative of average soils, climates, and seasons.

4th. That system, union of purpose, and concentration of effort are alone capable of giving the most certain and satisfactory results: Therefore, be it

Resolved, That a committee of five be appointed by the chair to whom shall be referred the subject of agricultural experimentation, and whose duty it shall be to report a series of carefully considered experiments bearing on the most important points in agricultural science and practice, to be conducted under the direction of the Commissioner of Agriculture, and in which the agricultural colleges and experiment stations of the country shall be invited to take part.

Mr. COOK suggested that it would be well to examine the original law of Congress establishing agricultural colleges and endowing them; that it called for the publication and exchange of annual reports, and if they are so exchanged between the colleges and read they should be the means of preventing this duplication.

Mr. RUGGLES. I rise with the expectation of remarking upon the co-operative system, which I think is embodied in these resolutions very fully, but I have upon my mind the questions discussed yesterday with regard to education which I wish to comment on in brief. It may not, perhaps, be considered appropriate, this morning, but if the question of co-operative work and action——

The **Chairman**. The question is on the adoption of the resolution offered by Professor McBride.

Mr. **Ruggles**. I do not propose to speak upon that point this moment, but rather to the point to which I refer, and also, incidentally upon the subject which I had proposed to present at the time when the president of the convention should deem it most appropriate—that of the practical production of fertilizers by steam.

The **Chairman**. I would state to the convention that I have a communication from General Ruggles, which I shall lay before the convention before its adjournment, and ask it to comply with the request to appoint the committee desired.

Mr. **Gillham**, of Illinois, expressed a desire to continue the discussion upon the agricultural colleges. The president stated that the question for consideration was the adoption of the resolutions, and that the report of the committee to which the resolutions would be referred could then be discussed.

Mr. **Porter**, of Minnesota. I will occupy but a moment. I represent the State Agricultural Society, the State Horticultural Society and State University of Minnesota, and representing these three organizations I heartily concur in the resolutions, and pledge the best co-operation upon the part of Minnesota.

Mr. **Aiken**, of South Carolina, stated that he thought experimental stations were invaluable; that he would like to see one in Washington, one in the South, one in the Middle States, one on the Pacific coast, one in the Mississippi Valley, and he thought that their establishment would result in great benefits to agriculture. He thought that experiments should be carried on, however, with reference to specific soils, climatic conditions, &c.; and predicted that all experiments carried on in one section, based upon success in another section, would fail unless these conditions were identical.

The experiments suggested by Professor Atwater might, he said, do very well for land worth $150 an acre, but where land is of no value, and labor is of all value, it was a different matter. Referring to Professor Atwater's suggestion of the application of nitrogen, Mr. Aiken said that in his first crop of corn raised in 1851, he had following his father's method, applied twenty five bushels per acre of a compost of cotton seed and common manure, and had a most beautiful corn crop, but very few grains on the cob.

The experiment suggested by Professor Atwater had been tried by every farmer in his country. It makes a fine weed, but nothing else; the application of ammonia to the plant is like giving liquor to a man, it makes the plant feel big, but it isn't worth anything. There was no farmer in his section who could afford to make the application as suggested by the professor, in applying such expensive fertilizers on lands that were so cheap.

Mr. **Aiken** believed that the application of phosphates to the growing crops would tend largely to increase the crops and reduce the expense. He gave his experience with a crop of wheat treated in this manner. To a 25-acre wheat field planted on the 9th of November, he applied his phosphates on March 10, and it was not a week before he could have followed his track by the increased growth. This method he has adopted, and he makes more than his neighbors. He has also followed with good effect the running through his sheep and cow stables of the phosphates, before treatment with sulphuric acid, using the product as his fertilizer. He stated that the use of cotton seed as a fertilizer was very little understood by the farmers of the South, and especially by the people of the United States. That where cotton is grown, the seed had become almost too expensive to use as a fertilizer, because of the demand for it for the purpose of making "salad oil." The people of the South are now trying to utilize it in another way. They find that a quart of cotten seed and a pint of oats will keep a sheep one day, and sheep do well all winter upon it. He wanted the professors to come out of their laboratories and go into the fields, and give the farmers the benefit of their labors there. Ninety-nine out of every one hundred never know what is meant by potash, nitrogen, and ammonia, or the difference between them.

Mr. NEILSON of New Jersey, stated that the experimental station there was in close connection with the farmers of that State, and they are directly benefited. Their wants are made known by correspondence with the station.

Professor CALDWELL had referred to the enormous number of papers extant, as the result of twenty five years' work of the German institutions, but that information did not reach us in this country for years, but there is an immense amount of information extant that cannot be had. He advocated the organization of a central bureau, where this valuable information should be gathered, collected, and distributed to the country. He thought the reason why the United States had increased so rapidly was, because of the cheapness of doing things. Emigrants are constantly communicating the resources of the United States to their mother countries, and the result of this meeting should be the adoption of a plan for the organization of a central bureau, for the collection and dissemination of such information.

The time for the usual recess having arrived, it was, on motion, ordered that the first half hour of the afternoon session be devoted to the further discussion of the question.

Before adjournment the chair submitted the following communication:

HON. GEO. B. LORING,
President of the Agricultural Convention:

SIR: I have the honor to state that I have invented a process of compositing manures and fertilizers by steam for agricultural uses. I have also the honor to request that a committee of five or more members of this convention may be appointed, if found expedient, to report their opinion whether they would consider it advisable that the subject should be experimented upon by the agricultural colleges here represented as a basis of instruction in the interest of agriculture.

DANIEL RUGGLES.

WASHINGTON, *January* 11, 1882.

The PRESIDENT. I ask leave to appoint this committee. Is there objection?

No objection being made, the following committee was appointed: Messrs. Gillham, of Illinois; Buchanan, of Virginia; Clark, of Vermont; Aiken, of South Carolina; Gold, of Connecticut.

And then, at 1.05 p. m., the convention adjourned until 2 o'clock.

AFTERNOON SESSION.

The convention reconvened at 2.20.

In accordance with the motion made before recess the discussion was continued. A delegate from Virginia thought that Mr. Aiken had made some strong points in favor of the adoption of the resolutions, one of them being the almost universal ignorance of agriculturists in regard to agriculture, and warmly advocated the adoption of the resolution.

Mr. **Holmes**, of North Carolina, said that speaking for the University of North Carolina he pledged the hearty support of that institution, and stated further, that they would be glad of an opportunity to carry on experiments in connection with those established at the proposed central station.

Mr. **Page**, of the University of Virginia, was satisfied that the scheme would work well, and desired to advocate it with all the influence he could bring to bear upon it.

Professor **Roberts**, of New York, said we had had a good deal of talk on phosphates, sulphates, and nitrates, but not a word had been said in regard to farm-yard manure, the foundation of all profitable farming. It had been intimated that professors of agriculture did not practice what they preached, did not use their fields instead of their laboratories as objects of illustration. Eight years ago the land upon which he is working produced less than 8 bushels of wheat per acre. It now produces 30 bushels. The highest yield is 46 bushels and 40 pounds. From sustaining a dairy of 14 cows and 4 horses, it now sustains 20 head of cattle and 20 horses.

This had been done by farm manures. He tried commercial fertilizers, but found, for some reason which he did not understand, that phosphates did not act energetically on the soil. He had tried one hundred experiments, carried on through eight consecutive years, and the greatest yield ever produced was from fourteen good two-horse loads of farm-yard manure, which he said did not lay out under the eaves of the barn. A large part of it was soluble, because of holes bored in the floor of the stable.

He had visited Professor Lawes' farm in England, and had been advised to use sulphate of ammonia. He had done so, and the result was no better than the phosphates. He had endeavored to find the reason, and found it to be true that certain localities are not adapted to certain treatment. A large area of country around Ithaca does not respond to phosphates. A large area to the north does respond, and farmers think they cannot get along without them; but these commercial fertilizers are only to supplement that that should be made of the by products of the farm. Referring to cotton-seed meal, he wanted to know why the oil referred to by Mr. Aiken could not be taken out, and the refuse used. Oil was not a manure. He had for two years manufactured farm-yard manures, carefully, and had tried to bring as much skill and education to it as would be brought to the manufacture of anything. If the manure is too damp, he dries it; if too dry, he dampens it. If it has been tramped down, he loosens it up. He has a yard where the manure is manufactured until ready for the field, when the 14 loads is applied per acre. The land upon which he produced the 46 bushels and 20 pounds of wheat per acre was extremely poor.

Mr. **Blount**, of Colorado, supported the resolutions. The land in his State (Colorado) was worthless, without water. Water, with him, was the great factor. The information to be derived from the proposed station would be of infinite value to his State; he thought the time would come when water would be one of the fertilizers. It costs $1.50 to irrigate an acre. For twenty acres, about $25 a year. They raise from 40 to 90 bushels of wheat per acre. The latter is not an uncommon yield, by plain cultivation. Corn becomes acclimated in about three years; wheat becomes almost indigenous to the soil. Wheat sent him by the department for the last three years would not be recognized; it gradually gets hard there. They use no fertilizers whatever. The soil 20 feet below is just as good as at the surface, and will yield the first year.

Mr. **Wells**, of Michigan. The Michigan Agricultural College is in favor of the passage of the resolution, and I would suggest that in each State where agricultural colleges are already established that they be made branch experimental stations.

Mr. **Brown**, of Indiana, said: The Industrial College of Indiana is opening up a State experimental station in connection with the agricultural college. He believed the resolutions were in the right direction, and wanted them passed. The question of time could be reduced by having men at work on the same point in different States.

Mr. **Wright**, of the Indian Territory, said: The western portion of the Territory is more or less prairie, and something in the soil causes sourness and does not permit the growth of corn. He suggested that the department, while investigating these matters, should ascertain the reason why corn does not grow in prairie countries.

Mr. **Fernald**, of Maine, thought the general scope of the resolutions commendable, and in behalf of the Maine State College of Agriculture and Mechanic Arts, he would say that it would join in this co-operative movement to the extent of its ability.

There were some features in the settlement of which all institutions could take part, as, for instance, the nitrogen problem, which several institutions in one section of the country could settle for that particular section in work of this sort. Not a very large number of experiments should be undertaken at any one time, but the few prosecuted thoroughly and for a series of years until regarded as settled.

The delegate from Maryland, Mr. **Warfild**, representing the Agricultural College of Maryland, situated nine miles from Washington, said: We have 286 acres of land that is well adapted for experiments, either as a central governmental station or as a co-operative experimental station, and the legislature would be very willing to offer any portion of it to the Commissioner of Agriculture, or to take up such experiments as the Commissioner of Agriculture would be willing and ready to have made; and I, therefore, on the part of the institution, in the absence of its president, make this statement.

Mr. **Sargent**, of California, was in favor of the adoption of the resolution. He thought that the arid regions could be increased in value by the experiments carried on under these resolutions. He believed that with a proper system of irrigation a vast area of these regions would be found to possess all the elements of fertility described by the gentleman from Colorado. He desired, if possible, to have a construction put upon the resolutions that should enable the proposed station to deal with the vast problem affecting this region, as for instance, to ascertain whether there are not vegetable fibers which will grow there. That region should be made to adapt itself to man's necessities, and to become what it should be, the new home of the many millions which this country by and by will contain.

Mr. **Alvord**. I merely rise to suggest that I think the matter of temperature, climate, condition of air and earth, have been too much lost sight of. I see we have with us a representative of the Signal Service of the United States Army, one of General Hazen's assistants, and I think we might, by common consent, extend the time sufficiently to hear from him as to what the Signal Service is doing and proposes to do.

The **President**: The chair will state that the question is not within the range of the resolution at all. The chair has extended an invitation through General Hazen to his assistant to prepare a written paper on the meteorological conditions for the consideration of the convention.

That question will come up at the proper time. It might come up this afternoon, after the paper of Professor Peabody; but I am informed that the gentleman has not had time to prepare his paper, and the matter will have to be passed over. Is the convention ready for the question?

There being no further discussion, the resolutions were adopted, and the following committee was appointed: Messrs. McBride, Caldwell, Atwater, Sargent, Alvord.

The chair takes pleasure in extending an invitation to all delegates to meet the President of the United States in the East Room of the White House at seven o'clock this evening.

The PRESIDENT. The business now before the convention is a paper by Professor Peabody, whom I have the pleasure of introducing to the convention.

WHAT WORK IS LEGITIMATE TO THE INSTITUTIONS FOUNDED ON THE CONGRESSIONAL GRANT OF 1862.

By SELIM H. PEABODY, Ph.D., LL.D., *Regent of the Illinois Industrial University.*

The great exposition in London, in 1851, was the first of those gatherings in which the workmen of the world have competed for supremacy in those arts which mark the development of mankind in the nineteenth century. It proved to be a grand awakening of the thought of the nations, America included, to the fact that those peoples who had most faithfully fostered the advancement of scientific discovery, with its application to practical arts, were making the most rapid stride in every line of material progress. Especially was it apparent in America that there was an imperative demand for higher technical instruction in every direction of human art, enterprise, and labor; in agriculture, in engineering, in architecture, in mining, and in all departments of manufactures. In a few particulars we had demonstrated the wonderful versatility of the American mind, its ready adaptability to new circumstances amid untried conditions; its fertility of invention; its quickness of acquisition; its grasp and strength, and tireless activity. With this demonstration camealso the conviction that the need of the time, the inexorable demand of the nation, was the need and the demand for technical instruction, such as could then be found nowhere on this side of the Atlantic. This leaven was fermenting in every thinking mind. A few schools were in operation. Efforts were everywhere made to open others. There was a school of engineering at Troy. There were scientific departments at Harvard, Yale, and Dartmouth. Pennsylvania and Michigan had founded schools of agriculture. Other schools of applied science were contemplated. There was great difficulty in securing the endowments, without which such enterprises could not thrive. As the want to be supplied was of national extent, as the benefits to be secured were such as would increase the nation's wealth and develop the nation's prosperity, the idea was born—some say in Illinois—to seek aid of the nation at the hands of the Federal Government.

During President Buchanan's administration a bill was introduced into Congress by Mr. (now Senator) Morrill, of Vermont, which bill provided that a part of the public domain should be distributed to the several States for the foundation of schools in which technical instruction should be given. The bill was advocated before the House in an able speech by Mr. Morrill; was thoroughly discussed and bitterly opposed in the Senate, and finally passed by a close vote, only to fail by reason of the veto of the President. During the first year of President Lincoln's administration the measure was again proposed; again passed both Houses of Congress, and became a law on the 2d of July, 1862. Nothing could have been more significant of the abiding faith which Congress then cherished as to the perpetuity of the Federal Government than the passage of this act in one of the darkest hours of the terrific struggle then going forward. No part of this act is more thoroughly familiar to each person who hears me than that section which so briefly, so concisely, yet with such generous provision, such breadth of permission, describes and defines the purposes to which the funds donated in the act shall be devoted. Apparently, as clear as the day, as luminous as light, the interpretations given to this section are marvelously diverse, and often diametrically opposite. I had almost come to think the subject trite and its consideration needless, and yet the discussions of yesterday have led me to believe that even now it may be wise to pause, hunt up the statute, and see how reads the law.

"The leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

What may be done legitimately in carrying into operation the instructions of this law? As has been suggested, each person has his own interpretation, and I crave brief forbearance while I present mine.

First. The business of each institution resting on this grant is TO TEACH.

An institution of learning, especially of scientific learning, has usually a twofold function, namely, the acquisition of knowledge and its dissemination. Either function may predominate, or the two may be made co-ordinate and mutually helpful. If, however, I read this law rightly, the end it requires is instruction. While it permits, by inference, in another place, that effort may be expended in the acquisition of knowledge, this permission is only by inference, and the labor so employed should be such only as may be made directly useful in stimulating and broadening and assisting instruction. If it be possible to draw a line sharply and distinctively between a school for the instruction of students, in which their mental growth and their scientific training shall be the absorbing interest, and an experimental station, in which the development of science in and for itself shall be the chief business, then the institutions founded on this act should be schools, and not experimental stations. A purely experimental station, however essential to science, however useful to the general welfare, however practical in the results which it may procure, if it be divorced from the instruction of pupils, does not answer the spirit of the requirements of this law. If the experiments can be so conducted as to help the advancement of the student, to quicken his perception, to broaden his judgment, to stimulate his energies, to illustrate the science in which he strives for the mastery, to assist even indirectly in the instruction which it is the real business of the institution to impart, then they are legitimate and should be fostered. The greater part of such experiments will not be found developing new science or breaking up new ground. The ground will be new to the pupil; the work will offer to him absorbing interest, because it is novel, and it will be imperatively needed by him either as teaching him how to conduct similar work in the future, or as illuminating the ground over which he must tread and with which he must be familiar before he can be fitted to enter upon fields wholly unexplored.

I dwell upon this point because it seems to have been assumed on one or two occasions, in our discussions, that if any institution, for want of opportunity, or of means, or because of other occupation, is not at work at some unsolved problem, and developing something new in science, it is therefore derelict in duty and is to be condemned as a failure. On the contrary, I believe that the time and strength of a professor, and in so far of an institution, may be so absorbed in that most interesting and fascinating employment, the pursuit of new science, and the solution of new problems, that he may neglect the more important duties of teaching the students who have been confided to his care. In most cases I apprehend that the conscientious teacher will find the time at his disposal all too short in which to conduct his pupil over the well-known ground of clearly established truth, and that the illumination which he can and must shed upon that truth will absorb all the means and time and strength at his disposal. His first and paramount duty is instruction. If his investigation will help his instruction, let him investigate; if it interferes with his instruction, let him obey the law and TEACH.

Second. What shall be taught?

With its wide latitude of permission, the law specifies but one subject which shall be taught, and that is military tactics. Possibly some of those who conduct the institutions in question would be glad if the act had been signed at its first passage, when this item was not included. Yet there may be grave question whether the schools would indeed be better if this requirement were omitted. The discipline, the physical culture, the development of manly vigor and gentlemanly bearing, the training in the use of arms and in the management of men, is worth, in my judgment, all it costs in a course of other study. The government, in all cases that I have known, has furnished the equipment when asked, and in most cases has detailed an instructor, free of cost, to the institution. I believe that good faith and simple honesty requires from every institution under this act, obedience to this item of the law, and that each student not physically incapacitated should be required to learn the manual of arms and the maneuvers and command of a company. The evasion of this law on the part of college governments is an unfortunate lesson to their students as to the doctrine and the duty of obedience.

But this item of military tactics is merely an incidental thing put into the act under the inspiration of the conflict which was raging when the act became a law. The grand purpose of the enactment is stated in the words, "to teach such branches of learning as are related to agriculture and the mechanic arts * * * in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

What does this mean? Why, says my farming friend, that means agriculture. The agricultural press throughout the country proclaims that it means agriculture. It has been so urged by members of this convention. The bill was known during its first and second passage through Congress as the Agricultural College Bill. The institutions founded thereon are commonly called the agricultural colleges. There is a large body of people in the country who insist that these colleges (1) ought to teach agriculture; (2) ought to teach nothing but agriculture, and (3) that they do not teach agriculture. Those who adhere to either of these propositions are in error in some greater or less degree.

It is certain that agriculture as a topic to be taught in these institutions is a topic of first importance. The law so states and so intends. But with equal precision the law requires that instruction shall be given in subjects which pertain to "the mechanic arts," that the students thereof may be prepared to enter the "several pursuits and professions of life." The law uses the same emphasis and the same authority in specifying the one item which it uses in stating the other. If the Massachusetts Institute of Technology, which enjoys a part of the income from the grant of 1862 to that State, errs in not teaching subjects which relate specifically to agriculture, the Massachusetts Agricultural College, which has the remainder of that income, errs just as grievously in that it does not teach subjects which relate specifically to the mechanic arts. But, nevertheless, the State of Massachusetts, having provided in these two institutions for instruction in both agriculture and the mechanic arts, fulfills her whole duty under the law. Her sons may choose the line of study which seems to them best suited to their capacities, their aspirations, or their hopes for gaining a livelihood. If, at Amherst, they have learned the principles and the practice of agriculture they have done well. If, at Boston, they have learned the theories and the arts which make them skillful mechanicians they have also done well. The State will be benefited by the genius and the skill of either. If the requirements of the law may thus without doubt be satisfied by these separate institutions, these requirements may with equal fullness be satisfied by the conduct of two or more departments in the same institution. The graduate who leaves such a school is not to be blamed even if he has not learned agriculture. He is to receive credit for faithful study and useful acquisition if he has perfected himself in any technical learning which has promoted his liberal and practical education for any of the several pursuits and professions of life.

For the term "mechanic arts," in the light of its subsequent amplification and explanation, is not by any means to be restricted to the arts of devising, building, and operating machinery, unquestionably included in that term. The art may be that of constructing the railway, as well as of building and running the locomotive that treads its iron track. It may erect the bridges that span the stream that track crosses. It may and should include the designing and construction of the stations that make its termini; or of any other edifices that men need to use in business, or want to love as homes, or to admire as monuments of public munificence. The science of the chemist that may develop the art of the dyer, or the skill of the assayer and the metallurgist, or of the refiner of sugar, or of use in the thousand forms of usefulness to which chemistry reaches forth its helping hand; the science of the electrician that builds our telegraphs, or will illuminate our cities and brighten our homes; the art of the designer that lends beauty to the products of the loom, that shapes the clay of the potter into things of perennial joy, that sheds its halo of delight over all things precious or common place, adding untold wealth to the crude products of rude mechanical toil; these, and a myriad more, in ways that science alone has opened and will open as the avenues to a livelihood or to a competency, are the lines of work that legitimately have place in the instruction of institutions of learning which the State has founded for the education of the industrial classes in the several pursuits and professions of life. Nay, more; unless the institutions in question do provide in some manner and to some extent for instruction that shall bear fruit in some of these ways, as well as in agriculture, they are delinquent in their duty towards the law which created them, and towards the needs of the public for whose benefit they are and were founded, for it needs no argument before this body to show that the greater the number, and the more diversified the nature, of the industries which occupy the labor and skill of a people the greater will be the prosperity of that people. It is no more fitting that all men shall be farmers, than that every farmer should raise only corn, or cotton, or hogs. When all farmers have learned how to make two blades of grass grow where but one grew before, there will not be occupation for as many grass-growing farmers as were required before that consummation had been reached.

It is true that these colleges, save as teaching may be divided as before indicated, are bound to teach agriculture. It is equally true that they are required to teach a wide curriculum of science and art beside agriculture. But it is said that they do not teach agriculture, and that they draw the sons of farmers away from agriculture, and teach them to despise labor. Most statements of this sort are based upon observation limited to individual cases, and so far as I am able to observe lack breadth of information. From the earliest days of the republic farmers' sons have turned their backs upon the farm to enter upon pursuits which required less manual toil. That the farm has furnished largely the fresh blood that has enriched the learned professions with strong and noble exemplars, has been the boast alike of the farmers and of the professions. From the farms went the Washingtons and Jeffersons, the Clays and Websters, the Lincolns and Garfields, whose renown has been the aureole about the brow of our nation of free laborers. Never have I heard that even the farmers have mourned because such men exchanged the labor of their hands for the severer and more exhaustful labor of their brains. But even these men never lost their affection for the soil whence they sprang; when wearied with the conflicts of the arena, whether victors or vanquished, they sought renewed vigor in the embracing arms of the dear mother who had nourished their sturdy youth.

It is sometimes asserted that enough of labor is not required at the hands of students, and that students who are not so made to work are not taught agriculture. If the work which can be put before students is something which develops manual skill, in which practice leads to perfection, in which brain has its part, then it is useful to the student, he loves it, and is always ready to attack it. Our American boys will always work when they can see the profit of it. They will not work kindly in school or after they leave school, at things which a dullard, or a brute, or a machine can do as well, and for the very sensible reason that they know it does not pay. The manual labor that is put regularly and systematically before the boys in one of the very best schools where this system prevails—work which was provided because no other was to be had—consisted mainly of such labor as spreading heaps of manure, chopping brush, digging potatoes and ditches, and other occupations of like drudgery, which most knew all about before they came to college, and which any of the others learned to do perfectly in the first hour's trial. That which the boy comes to college to learn is not that which he has already learned or can learn at home; he were foolish to go from home for such instruction. He goes to learn something which his farm work will not bring to his knowledge.

Nor is it true that these colleges educate the boys away from the farm or away from labor. Of the students who attend the Illinois Industrial University about 75 per cent. come from farmers' families; 80 per cent. are young men. About 55 per cent. choose technical courses, divided with considerable uniformity between agriculture, chemistry, architecture, mechanics, mining, and civil engineering. It rarely happens that a student leaves a technical course for a literary course, while it is a common occurrence that one who has witnessed the practical work about him, the fullness of experiment, and the interest it awakens, it is common that such a student turns from a literary to a technical course. Our paths lead toward science, rarely from science. Farmers' sons who come to us and enroll their names as taking other courses of study very frequently pursue some parts of the agricultural course, as collateral work, intending at the end of their college life to go back to the farm, so that it is now true that a much greater per cent. of our alumni are farmers, than the percentage of our students who are, or were, special students of agriculture.

As a rule, young men choose such courses of study as they believe, from the best information in their possession, will lead them to immediate and lucrative employment. Especially is this true of students in technical schools. If young men could be brought to believe that trained agriculturists could command wages commensurate with the expense of the training, ten would undertake this course of discipline for one who now enters upon it. Such demand for educated farmers as has been described at this convention may exist; but such knowledge of it as will help intending graduates to find business after graduation, does not come to those who have charge of institutions, who would gladly bring employers and employés into communication. During the last year the officers of the institution I represent furnished fifteen to twenty assistants to engineers of lake and river surveys, and of railway lines, applying for such help. This year the engineering classes are crowded. There is a like demand for machinists and architects, and with like results. The same conditions do not exist for agriculturists.

The Illinois Industrial University offers a wide opportunity for choice of studies to those who knock at its portals. First and completest has been its equipment for agriculture. It has one hundred and fifty acres of land devoted entirely to experimental uses in agriculture, horticulture, arboriculture, orcharding, vineyards, small fruits, druggists' herbs, anything which may promise useful variety to tillers of the ground. It has a stock farm of 400 acres, on which students are shown the conduct of the business of raising crops and feeding cattle with a view to economy and profit, and this farm yields annually a fair remuneration to the treasury of the college. It keeps constantly from 150 to 200 head of cattle of all ages; some of gentle breeding, others of graded stock of various qualities and strains, by which to illustrate their relative value for profitable handling. It is well supplied with tools and implements that are carefully managed and tested. The department is under the charge of a professor (Prof.

George E. Morrow), of whom I would gladly say more if he were not here present to object. We have yet to learn of his superior in the West. The professor of botany and horticulture is equally master of his specialties. Competent collateral instruction is fully provided.

The courses in agriculture are greatly varied. If a student can afford time for a complete course of four years, he will find every term thereof crowded with profitable work. If one year is all that he can give, a course of special technical work is arranged for him. If he would choose a course for himself, of greater or less length, the choice is limited only by his own advancement, or by the current programmes of the terms. If the winter term is one which he can spare from active labor on the farm, a series of lecture courses is open to him, for which no special preparation is required. Finally, in most years, a farmers' institute of one week is held in January, to which all farmers are invited. If there is any way in which agriculture can be offered by which it can be more attractive, or more profitable, or better adjusted to meet the wants of the recipient, we shall be glad to be advised of that way. Yet the fact remains that comparatively few students out of our whole number take a course of agricultural instruction in any of the forms mentioned. The truth is that our Illinois farmers cultivate a soil so fertile, so sure to honor their drafts, that they cannot abuse it so badly but it will give them always a support, and generally bountiful profits. These farmers cannot realize that agricultural education can increase their profits, or improve their situation.

I will not take space to detail the equipment of our university in other technical departments. Our laboratories and shops, the machine-shop, and the carpenter's shop, are full beyond our means of supplying room and tools. The young men are eager to work in these specialties. One year ago, through the liberality of the secretary of state, a room in the State capitol at Springfield, spacious, elegant, and most conveniently situated, was placed at my disposal, in which was arranged an exhibit showing the products of students' work alone, all other being strictly excluded, which required two freight-cars to transport from Champaign to Springfield. Each school of technical art was represented—agriculture and horticulture, with fruits and grains and wood and models. Chemistry, with a long list of chemical and pharmaceutical preparations, and an exhibit of sorghum products of great variety, and of good quality. Mechanism, with a complete set of its shop-practice objects, and a large collection of mechanical models, all made by student workmen. A like set of shop-practice objects from the carpenter-shop, with accurate models of roofs, bridges, stairs, and every form of joiner and cabinet work. Specimens of natural history, mounted with life-like grace and beauty, and drawings from all schools, conspicuous for accuracy, perfection, and adaptation to useful art.

This university has passed the time of telling what it proposes to do and what it hopes to accomplish. It has entered upon the stage where it can show something which it has done; yet it is to be hoped without being in any sense content to rest upon any laurels it may have won.

I have thus far spoken of the duty of the so-called agricultural colleges to furnish instruction in branches which may lay the foundation for a means of getting a living. But this is not the noblest function of an institution designed to train the young, whatever may be the practical end immediately sought. The first business of any school is to develop men. Those whom the honorable Commissioner (Mr. Loring) described to us yesterday as wanted, as in eager demand, a demand far beyond the supply, for agricultural employment as florists and gardeners and farm managers; those whom the distinguished gentleman from South Carolina (General Aiken) desired to transplant to his sunny fields as farm superintendents, were in every case to be men. Men of good brain, of good muscle, in full health and stalwart vigor, physically, mentally, morally. They must be men of fair culture, ready in business, in the market, in society, in the discharge of every duty as citizens, to meet and wrestle with the men who are trained in other schools and by other methods. A fatal error will have been committed if their training has been confined to the technical studies which, however useful they may be, are useful in only a certain narrow and limited scope. There must have been developed a power to think clearly and quickly; to reason logically; to express fluently and intelligibly the ideas which have been gathered in the school, or have germinated in their own minds. There is value in all the culture of finer grain which comes from any acquaintance with the humanities, with the thoughts of men who lived in other ages, and spake in other tongues. If there be any form of education that makes any man stronger and wiser and nobler, the farmer and the artisan, the machinist and the engineer, the architect and the designer, and especially he who in any capacity is to be the guide and director and controller of men, needs that culture, that education in its fullest extent.

And so it was that the man who drew this act under which our schools have the right of life and of maintenance, added that these things which were specified, and which we have at some length discussed, should be done and taught "without excluding other scientific and classical studies." The technical studies are to be first provided for, but there shall be no prohibition or exclusion of other scientific subjects, or even of the classical studies which so many who affect to be practical pretend to despise. Practical training is demanded and liberal culture as well is to be cherished. If the farmer's boy tastes a little Latin it will not harm him. Even if, as is rarely the case, he unearths a Greek root, phosphorescent with age, it will not destroy him. If the mechanic or the engineer, or the technical student in any specialty, would open the doors which look into French or German apartments in the temple of science, he will find there stored vast accumulations of precious learning in the very things which he most earnestly covets, which possessed, will add vastly to his stores of knowledge, while the act of acquisition will give keener edge and quicker play to the weapons of his mental armory.

For every mind a discipline is needed which comes from an acquaintance with other subjects than those pertaining to pure science, or to applied science, however useful those may be. The graduate of any higher school ought to know something of the laws of his own mental activity; something of the principles and methods of the government of which he is a part, and which, in some of its higher or lower departments, he may be called to administration; something of the laws of wealth and the great economies which govern production and distribution and consumption; something of the physical history of the world and of its relation to the rest of God's creation; something of the history of his own race, as it has lived on this earth, with the details of the grand march of history along the highway of nations; something of his own language and its literature, the thought, pregnant with power which the creative minds of his own and of elder days have produced, and which now, in many unrecognized but forceful influences, make up so much of the staple of our thinking and of our present culture. Never does the student gain all his acquisitions at the feet of his preceptors. The outlines only are there acquired; the impulse is received; preferences established, mental bent obtained; the development progresses while the thinking mind endures. But the doors into all these apartments of human knowledge, and to all these sources of higher culture, should have been opened to all young men and women that they may at least know what munificence of intellectual wealth lies within their reach, and these opportunities should be furnished in the technical, as well as in the literary or the classical school.

What is legitimate to the schools resting on the grant of 1862?

All forms of technical education, and in the wide scope of possibilities, every form of human learning which it has fallen to the fortune of mankind to devise or acquire.

The CHAIR. The paper is now before the convention for discussion.

Mr. WARFIELD stated that the paper expressed the sentiments of the faculty of the Maryland College. The question raised was one which he had often proposed and debated in conventions, and in all cases the preponderance of opinion was that a man to make a progressive, active farmer should know something of every department of science. That had been the idea of his college, but a narrow-minded legislature had crippled them. He referred to a meeting held in Washington two years ago, at which resolutions were offered and carried asking Congress to devote at least one-quarter of the proceeds from the sale of public lands to the further endowment of agricultural and mechanical institutions. He advocated the passage of a resolution looking to the appropriation of some portion of the $200,000,000 now lying in the Treasury for the further endowment of these institutions, that the work so ably and intelligently begun may be carried to completion.

Mr. HEDGES, of Missouri, spoke of the urgent need of some fostering care in the production of our own sweets—sugar and molasses—and dwelt at length upon the development of the sugar industry throughout the North and West during the past few years.

Mr. BAIRD said that if the causes set forth by Professor Peabody for the lack of interest were real, which he was inclined to question, that it rather reflected upon the kind of agricultural education given in the Illinois University. Michigan had no trouble in filling her agricultural colleges with students. That State had a university as well known as any in the country; students were given a four years' classical course, and every student who graduates at the college has to take agriculture, and the sciences which underlie it. He warmly defended the management of the industrial institutions of Michigan, and testified to the benefit the farmers derived therefrom. He did not believe there was any excuse for the lack of interest in the agricultural education, and explained at considerable length the workings of the Michigan Agricultural College.

A delegate rose to second the remarks made by Mr. Baird, stating that the colleges of his State are based upon the plan of Michigan; that students were taught to labor rather than to ignore its importance—to labor in the field at practical work.

Mr. Daniels, of Virginia, followed in a speech advocating the teaching of students to combine the work of the hand with the work of the brain.

Dr. Gregory had been connected officially with both the Illinois and the Michigan Agricultural Colleges. He ascribed the success that had attended the Michigan Agricultural College to the fact that the college was three miles from anywhere, and that the boys were obliged to board in the buildings and live on the farm, thus confining their attention to matters pertaining to their studies there.

In the course of a long speech upon the advantages of this system, Dr. Gregory stated that upon the occasion of a visit to Baron Liebig he had stated to him that the great question agitating the colleges of this country was the relative value of agricultural colleges as separate institutions and as connected with the universities. The baron replied that there was no doubt in the matter, and referred him to what he considered the best agricultural college, which was found to be connected with a theological college.

Mr. Fernald, of Maine, spoke of the valuable paper to which the convention had listened, and hoped a goodly number would be printed for distribution. He referred to a bill in Congress looking to the further endowment of these institutions, and spoke of the benefits to be derived from such further endowment. He called the attention of those present to one point in the bill, the general method of distribution. For the first ten years the distribution from the proceeds from the sale of public lands and patents is to be based upon illiteracy. He questioned the propriety of such a distribution, as it gave to those States having a large percentage of illiteracy many times the amount for ten years that would be given to those having a smaller per cent., and he thought that a change in the bill should be effected.

The Chair suggested that a committee of three be appointed to wait upon Mr. Morrill, the author of the bill, instead of appealing direct to Congress, as he had no doubt a proper understanding of the bill could be reached.

Professor Roberts moved that a committee of three be appointed to take into consideration this matter, to be designated by the chair. The motion was agreed to, and the following committee was appointed: Messrs. Roberts, Fernald, and Warfield.

The President. The chair will state that any committee appointed at any one convention will have the privilege of reporting at any time during the sessions of the several conventions.

Mr. Holmes, from the committee on permanent organization, reported the election of Dr. G. B. Loring as chairman of the various conventions.

The President. I desire to say that I am perfectly willing to do anything desired by the convention, and, in accepting the honor, I reserve the liberty to call other gentlemen to the chair whenever necessary. The first business in the morning will be a paper by General Jackson, of Tennessee, upon the blood-horse, and a very interesting, very useful, very entertaining paper it will be. The discussion which will follow this and other papers will be extremely interesting, I have no doubt.

There being no further business, the convention adjourned at 5.10 p. m.

JANUARY 12, 1882.

The convention was called to order at 10.12 a. m.

Professor Holmes presented the report of the committee on permanent organization, as follows:

> The committee on organization nominate the following officers of the Convention on Animal Industries:
>
> *Chairman*, Dr. Geo. B. Loring, of Massachusetts.
>
> *Vice-Presidents*, in addition to those named January 10:—Dr. Jas. Law, of New York; General W. W. Grout, of Vermont; Mr. Warfield, of Maryland; Col. Robert Beverly, of Virginia; Mr. S. M. Emery, of Minnesota; General Wm. H. Jackson, of Tennessee; Hon. Geo. R. Black, of Georgia; Hon. D. B. Gilham, of Illinois; Hon. D. Wyatt Aiken, of South Carolina; Mr. J. D. Whitham, of West Virginia; Col. James Young, of Pennsylvania; Maj. Campbell Brown, of Tennessee; Mr. Z. A. Gilbert, of Maine.
>
> *Secretaries.*—General Geo. E Bryant, of Wisconsin; Mr. James Neilson, of New Jersey.
>
> JAS. A. HOLMES,
> *Secretarg of Committee on Organization.*

The CHAIRMAN. I would suggest that it is very desirable that delegates having papers to present should give their titles to the secretary in order that they may enter them on the programme of each day's proceedings. The first business in order this morning is the reading of a paper on the "blood-horse," by General Jackson, of Tennessee, who I now have the pleasure of introducing to the convention.

General JACKSON. *Mr. President, and Gentlemen of the Convention:* Before proceeding with the reading of the essay which has been assigned me by the President of the Tennessee Stock Breeders' Association, on the "Blood Horse," you will, I hope, indulge me in a few remarks touching the Department of Agriculture. My long association with agricultural organizations throughout the West, South, and Northwest, sometimes as a private in the ranks, at others presiding over the deliberations of those conventions, leads me to say that the general impression that has gone out respecting the Department of Agriculture is that it has been deficient in those practical results which the husbandmen of the country so much desire. To use a medical simile, for the office of Commissioner of Agriculture, they think that his normal condition is *otium cum dignitate* and, if by reason of some pet theory the pulsations of the heart are caused to be too frequent, he restores himself to his normal condition by changing the formula to *otium cum digitalis.*

Now I am happy to compliment the present Commissioner of Agriculture in what I deem a new departure, and for myself, I see in this movement evidence of what I think will be productive of good. That these meetings for consultation and discussion *are* productive of great good, I know from my experience in the past, and recognize the fact that we have only to look at the associated effort in mining, manufactures, and railroads, and the many channels through which capital seeks accumulation, to convince us of the necessity of this concert of action. I am gratified and rejoiced to see present with us such a number of the law-makers of the country, and it is a sign of improvement when these gentlemen lend us their presence, and I hope it will result in encouraging and promoting this grand work, for, gentlemen, permit me to say that that business upon which the permanency and splendor of the government rests, should receive that degree of consideration, protection, and encouragement from the law-makers of the country which, by right, the farmers of our land are entitled to by reason of the taxes and revenue imposts paid by them. Again, I see signs of improvement in this. I believe that our present Commissioner of Agriculture, aided by the general government, will make this department what it should be, a grand receptacle of reported experiments of theory and practice; that he will receive them here at this central station of experimentation, and in this grand national laboratory, so to speak, submit them to the crucial test, eliminating the pure grain from the chaff or the practical from the impractical, and send them forward from this great national focus that they may radiate to the great fields of agriculture, and there, like bread cast upon the water, return in a short time to enlighten the minds and gladden the hearts of the husbandmen, while still further strengthening this rich government. I deem it proper, gentlemen, to say that it has been a pet theory of mine to enlarge this Department of Agriculture so that it can be productive of practical and grand results. As a farmer, I would state that my self-respect will always impel me to use all legitimate means to ennoble and dignify the vocation which the Creator of the universe honored by planting the garden eastward in Eden, and requiring man to dress it and keep it. As a citizen of this great republic, destined to lead the civilization of the world and spread abroad over the earth the benignant rays of a pure Christianity, it is my duty and my pleasure to contribute my mite to the enlightenment and the progress, to the refinement and culture of that class which, like the granite that underlies our mountain chains, sustains the burdens of government, while it gives stability and strength to the great principles which should mold and control and fashion the grand superstructure of human society. I would state that the subject of my essay, as I have said before, was selected for me by Major Vanderford, president of the Stock Breeders' Association of Tennessee, and is a subject which is in entire accord with my taste. The ideas and observations which I shall present are the joint productions and the experience of the veteran breeder, General W. G. Harding, of Tennessee (with whom I have enjoyed intimate association for the past thirteen years), and my own. I would state that I had but a few days' notice before proceeding to Washington for the preparation of this, and I owe my apology for the crude essay which I have now to present to your honorable body:

ESSAY ON THE BLOOD HORSE.

By W. H. JACKSON, OF TENNESSEE.

MR. PRESIDENT AND GENTLEMEN OF THE CONVENTION: The subject of my essay, "The Blood Horse," was selected for me by Major Vanderford, the president of the Stock Breeders' Association of Tennessee, and notification given me a few days before leaving for Washington. I offer this in apology for the crude one I now present to your honorable body. The ideas and experience herein given are the joint productions of the veteran breeder, General W. G. Harding (with whom I have been associated most intimately, under the same roof, for the past thirteen years), and my own. I have no doubt Major Vanderford supposed that all other subjects pertaining to "animal industry," except this one, would be occupied, hence his reason for assigning it to me.

Among all the numerous varieties of domestic animals which a benevolent Providence has created for the use of man, the blood-horse stands pre-eminent, without a compeer in the animal kingdom. The uninitiated may ask, what do you mean by a thoroughbred or blood-horse? I mean the horse which traces back, with certainty, through a long line of distinguished ancestry, to the beautiful and game little creat ires, which were imported into England from the deserts of Arabia about the middle of the sixteenth century. How they came to Arabia, or by what means they had been brought to the degree of perfection they possessed at that early period I am not able to answer.

THE SUPERIOR CHARACTERISTICS OF THIS ANIMAL.

In beauty he is without a rival in the equine family; a coat as fine as satin, his eye in repose as mild and gentle as the lamb; under excitement as bright as the eagle and as bold as the lion, denoting the energy of his nature; his skin as thin and elastic as the fawn; his form as perfect and well placed as beautifully defined muscles can make it.

This is his exterior, or that which is visible to the naked eye; but there is an interior or invisible structure that contributes more, perhaps, to his powers than even his perfect exterior formation. His large heart and capacious lungs give him the wind of the high-bred hound; his large blood-vessels and soft, thin skin, enable him to throw off the excess of heat that must be generated by great and rapid exertion, especially in a heated atmosphere; his muscles, firm and beautifully defined, with bone of ivory texture—all combine to give him strength, endurance, action, and beauty far exceeding all of his race.

The uninstructed in this particular branch of animal industry may inquire, how do you know of this internal and invisible structure? The veterinary surgeon will answer, "By dissection of blood-horses we find universally large heart, capacious blood-vessels, thin skin, and ivory-like bone, possessing solidity, and consequently strength, far superior to coarse breeds." Therefore, when we know that the pedigree is pure, we also know that this perfect internal structure exists. From the time of the introduction of this horse into England to the present, the best talent of intelligent breeders has been zealously and energetically employed throughout the world, aided, too, by all the leading governments (except our own) to develop and improve this noble animal. They have not failed. By attention to his comfort, with a liberal supply of proper food from infancy to maturity, his size has been enlarged, consequently his strength and speed increased; though beautiful when brought from his native desert, he has attained such perfection in symmetry and strength that breeders of the present period are puzzled to know what further improvement can be anticipated.

The many admirable qualities I claim for this magnificent animal do not constitute his chief, nay, nor his greatest value. His high mission is to improve all of the equine race. The pure and unadulterated blood that flows in his veins improves and gives additional value to all the horse family. To the child's pony it imparts more action, sprightliness, and beauty; to the saddle-horse more action, durability, and style; to the trotter, a class of animals at present so highly prized and for which such fabulous prices are paid, this blood is indispensable, for without it, with all his strength, when pressed, his muscles will tire and he will grow weak for want of breath, the natural result, not of his exterior formation, but of his defective internal organization.

I quote from Col. Jno. P. Reynolds, then editor of the National Live Stock Journal, published at Chicago, on this subject, as follows, viz: "So far as we are advised and believe, there is no individual fast trotter, nor admitted family of trotters, whose blood, if known, is not traceable in part to the thoroughbred. In other words, thoroughbred blood, if not the foundation, the *sine qua non*, of speed at the trot, and, we may add, at any other gait, is always present where speed is found. There is no speed without blood; and we think the inference fair, that none is expected." The question is frequently asked, with all the perfection you claim for the blood-horse, do you esteem him the horse of all work? I answer, No. The horse of all work is a misnomer. No such horse or breed exists. The horse is now an inhabitant of all countries, of nearly every clime, from the torrid to the frigid zone; used by all people (civilized) under varied and totally different circumstances and for different purposes; of course no single animal or breed can be best adapted to all those various circumstances and conditions, but I affirm that he is better adapted to a greater variety of uses than any of his race.

The veteran breeder, General Harding, after an experience of forty years, says: "The best and most durable plow horse I ever owned was a thoroughbred. On a hot day and in high corn (the most severe test for farm stock) he could kill all the horses and mules that would keep up with him, without injury to himself. The best, most active and durable saddle-horse I ever owned was a blood-horse. I rode this horse until he was twenty-four years of age before he ever fell with me or made a bad blunder. I then set him free, and had the pleasure of providing for his comfort for several years after.

The best harness horses I have used were well bred. I find them more sensible and more bold, consequently more safe and reliable. The best mules I ever worked were from thoroughbred mares. Indeed, no animal is more improved by a dash of blood than the mule; it imparts to him the action and spirit which he so greatly needs. To form an idea of the wonderful powers of the blood-horse, we will suppose his weight

950 pounds, this being about the weight of the average race horse. By the strength of his muscle he carries this weight together with his rider (110 pounds), making 1,060 pounds, not on a down grade, but on a horizontal line, a mile in one minute thirty-nine and three-quarter seconds, almost equaling the power of steam; of all animated nature the feathered tribe alone can equal his speed. If we imagine a feathered monster of equal weight, I doubt much whether he could surpass him in his flight. Persons not versed in the art of breeding this animal have but an imperfect idea of his history, or of all the care and labor bestowed in his preparation from the Arabs down to the present time.

I here quote from an old English work on English race-horses, published in 1810:

"The mountain Arab is allowed by all writers to surpass the rest of his species. Arabian horses are the most beautiful, they are larger, more muscular, and handsomer than the Barbs. The Arabs, with care, and for an amazing length of time, know the races of their horses—they know all their alliances and genealogies, and they distinguish their races into three different classes: The first, of a pure and ancient race, they call nobles; the second are also of an ancient race, but they have been degraded by vulgar alliances; the third class consist of their common horses. Those of the first class are excessively dear; a very fine horse of this pure breed is worth £3,000 sterling, a price almost incredible. When the son of an Arab attains the age of maturity, his father, agreeable to custom, presents him with his blessing, two suits of arms, two cimeters, and one of these horses, which is considered a sufficient portion.

"Mares of the noble class are not permitted to be covered, except by horses of the same quality. The Arabs, by long experience, know all the races of their own horses, as well as those of their neighbors. They know their names, surnames, colors, peculiar marks, &c. When a family have no noble stallions they borrow one of a neighbor to cover their mares, which is performed in the presence of credible witnesses, who give an attestation of it, signed and sealed before the secretary of the emir, or some other public person. This attestation contains the name of the horse and mare, and a complete history of their pedigrees. When the mare has foaled, witnesses are again called, and another attestation is made, including a description of the foal, and the day of its birth. These attestations enhance the value of their horses, and are always delivered to purchasers. When a mare brings forth a male colt, the pious Arab, in gratitude to the Supreme Power, offers up the same sacrifice he does at the birth of a son.

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"The tent of the Arab is also the stable for his horses; the mare and foal, and the family of the Arab, live together promiscuously; these mares are so accustomed to society that they submit to every kind of familiarity.

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"That Arabia is not only the original climate for horses, but the best suited to their constitution.

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"The shankbone of a blood-horse is solid and close in its contexture, the cavity scarcely admitting a straw; whereas the shank of a cart-horse is very porous, and will almost admit your finger."

No human history equals it in point of accuracy, nor human pedigree in point of purity of blood. His genealogy is traced through many generations, back to his Eastern origin without a shadow of doubt. (Spurious pedigrees, though sometimes attempted, are easily detected by the experienced pedigreeist.) This animal is admired by all men, but by the uninformed as a beautiful creature, many of whom imagine he is bred for the race-course only, and is fit for nothing else, has no other value than occasionally to contribute to the amusement and sport of the public. This is an egregious error. The race-course is only the school to educate and prepare him to exhibit his wonderful powers in competition with the best of the royal family. The race-course is, therefore, a necessity, for through its instrumentality the blood-horse has been brought to his present high degree of perfection. Human judgment is often in error, but on no subject more frequently than in the opinion we form of the relative power and value of the horse. It is as easy to judge of the powers and qualities of man by the eye, and all will admit the fallibility of such judgment. No, we can only judge correctly of the intellectual and moral worth of our great men when we view them on the world's stage in competition with distinguished competitors.

Without the theater the world could never have known those distinguished delineators of human character whose names now fill many an honored page in human history.

Without the race-course the world would never have known of the great powers of Lexington and Vandal, the horses which have contributed more to the improvement of our horses in later years than any others

aware of the prejudices existing against the race-course by religionists, generally nt of its immoral tendency; that these prejudices are not altogether ground-less I admit, but that the immoralities of a well appointed and well regulated race-course are greatly magnified by those who know the least of their operations I am perfectly satisfied; that it may be still further improved, and all objectionable features removed, I earnestly desire. From my observation I can affirm that vice and immorality do not necessarily attach to racing, and that a gentleman, when guided by prudence, may promote and encourage this fascinating out-door amusement, and the development of this the noblest of all domestic animals without impairing his fortune or sustain the least reflection upon his morality, and demonstrate that *unsullied honor* and *integrity of heart* are compatible with the appellation of turfman and sportsman. I have only to cite General Washington, the father of his country, and General Andrew Jackson as shining examples of the true and keen sportsmen, fond of the thoroughbred horse and the hounds.

ORIGIN OF THE ENGLISH BLOOD-HORSE.

The English thorough-bred is descended from the Darley Arabian, imported into England in 1703, being then four years old, and the foundation of the present improved stock of English race-horses is to be attributed to the Darley and Goldolphin Arabian. Though previous to the importation of the Darley into England, several Barbs, Turks, and Arabians, mares as well as horses, had been brought into that country, and crossed on each other; but none of them had been able to establish any imposing reputation by imparting to their stock that size, bone, strength, and substance, those extraordinary and unequaled powers of speed and continuance which were afterwards attained through the agency of this noble animal.

For the benefit, and I hope for the pleasure of my hearers, I will append here the description of the two stallions, the Darley and Goldolphin.

The Darley Arabian was a bay horse, 15 hands high, strongly and elegantly formed, with a blaze in his face and his near fore-foot, and both hind feet white.

The Goldolphin Arabian followed the Darley, and twenty-five years later, and though he enjoyed greater reputation than the Darley, many writers of that day attribute his success to the advantage of the labors and improvement of stock accomplished by the Darley. Flying Childers and Eclipse, the swiftest beyond a doubt of all quadrupeds of that time, were the son and grandson of the Darley Arabian.

The Goldolphin was an entire brown bay in color, 15 hands in height, of great substance, of the truest conformation for strength and action, bearing every indication of a real courser, a horse of the desert. He had mottles on the buttocks and crest, with a small streak of white upon the hinder heels. He was imported into France from some capital or royal stud in Barbary. He is said to have been foaled in 1724. Mr. Coke brought him over from France and gave him to Williams, master of St. James Coffee House, who presented him to the Earl of Goldolphin. He is said by French writers to have been bought for 18 louis, about $75. He died in 1753, the most successful as a stallion of any foreign horse before or since imported into England. *

To sum up from my reading, I think the English race-horse derives much of his beauty and speed from the Arabian; his strength and stride from the Barb, and his size and height from the Turk.

The first thorough-bred horses imported to this country were to the State of Virginia, and were Bulle Rock, imported in 1730, before the Revolution. He was foaled 1718, and traces back to 1689, 1686, and 1584, and Dabster, imported in 1741. Since that date millions have been expended in the importation of stallions and mares from England and France.

I present here a list of those horses imported to this country, which have left the most lasting impress upon the blood-stock of America, named in the order of merit, viz: Diomed, Glencoe, Priam, Leamington, and Bonnie Scotland. The most noted of our native stallions are Sir Archy, Medoc, Lexington, Vandal, Longfellow, Virgil, Enquirer.

The most noted of the brood-mares of England have been Pocahontas, by Glencoe; Queen Mary, by Gladiator; and Alice Hawthorne, by Melbourne or Windhound.

The most noted mares imported to this country are Gallopade, Britannia, and Weatherwitch.

The most noted of native mares are Reel, by Glencoe; Magnolia, by Glencoe; Picayune, by Medoc; Madeline, by Boston; Sally Lewis, by Glencoe; Maggie B B, by Imp. Australian; Madeira, by Lexington; Nevada, by Lexington; Nantura, by Brawner's Eclipse; Susan Ann, by Lexington; Vesper Light, by Childe Harold; Farfaletta, by Australian; and Florine, by Lexington.

In breeding, the requisites for a stallion are: 1st, purity of pedigree; 2d, perfection of form; 3d, performance on the turf; 4th, smooth, easy action; 5th, strong constitution and good temper or disposition; 6th, unquestioned courage. In selecting brood-mares, have an eye to purity of pedigree, and that they spring from a family of note performers on the turf. Then select mares that are sound, healthy, large-bodied, capacious in trunk, and who yield a large quantity of milk; in other words, who are goo nurses; due care should be given in the selection of mares, as they contribute more to stature and constitution than the sire. I prefer the heavy-bodied mare, 15 hands 1 inch to 15¼ hands in height.

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* He was a Barb.

The stallion and mare should be mated, with a view to the difference in blood. and to correct any defect in form that may exist in the one or the other, in order to attain the best results. The mare, after being stinted to the horse, should be tried every tenth day for sixty consecutive days, or until she goes out of season, keeping her in a quiet place until she has conceived. The period of gestation, for a mare, is about eleven calendar months and nine days. While carrying the foal, the mare should be provided with a comfortable paddock, or four or five mares to a six or eight acre paddock, with a good shelter or box-stall (14 by 16 feet), and given a liberal supply of sound Indian corn, oats, or barley, and good timothy hay, having access to pure water; she should be permitted to run out in paddock in all weather that is suitable, and confined in stall when the weather is cold or disagreeable, especially a damp cold; a clear, dry cold it is better for the mare to run. The strength of the foal, and subsequent usefulness and size of the horse depends largely, in my opinion, on the care and attention bestowed on the dam while carrying the foal.

About the time when you suppose the mare will bring forth her colt, she should be carefully attended by a competent stud-groom, who can assist her if anything wrong takes place. The mare should never be permitted to foal in a paddock that has running water in it, as she will certainly go to water after her delivery (she being feverish), the young foal will follow, and I have known them, when staggering about like a drunken man, fall into running water of the depth of three inches and be drowned. As soon as foal is dropped, the breeder should record the date of foaling, the sire, dam, the sex, and color, and the markings, with minute care. The foal should be gently and tenderly handled for the first eight days, until it will come and lick salt from the hand, and the mare should not be permitted to go out where the foal can lay down on the damp, cold ground, until it is four or five days old. The foal should run with its dam until weaning time; say, if foaled in the spring, until middle of October or 1st November; the foal should be fed with good oats or ground barley from the time it is two months old (a pen at the end of the trough, where the mares are fed, should be made for the purpose of feeding the young things, so that the mares cannot interfere with them when feeding). The *modus operandi* of weaning the colt (which we do at any time from middle of October to middle of November, in Tennesssee), is to bring the dam with its foal to the stall which the foal is to occupy (usually 10 by 12 feet). The foal is placed next to one of the sides of the stall, and the dam is held by two men against the foal, when the stud-groom passes under the neck of the mare and places the halter over the colt's head and buckles it on. By this process the first lesson is given quickly, quietly, and gently; the foal can neither go backwards or lunge forward, and can only dodge its head a little. After haltering fix a strong plow-line cord, 7 or 8 feet in length, to the ring of halter, and throw the cord upon the ground or floor; this serves the double purpose of catching the foal easily when you enter the stall, by taking up quietly the end of cord; also serves to teach the colt to stop when it steps on the cord, and gives it the first lesson in obeying the check; then let the colt remain in the stall three or four days before leading out into the stable-yard, giving it one or two lessons each day in the stable, by pulling the cord and turning it about; after three or four days, when it has forgotten its dam somewhat, fasten an extra length of cord, making 15 or 20 feet, and lead out, having a man in rear of the colt to motion at it, with whip to drive it along; walk it about quietly for ten or fifteen minutes (the first lesson), give a bunch of green grass, and return it to stall; continue this lesson from day to day until they are gentle enough to turn out in paddock and catch up handily.

Barley paddocks should be provided, and in all suitable weather the weanlings should be out in paddocks—the colts separated from the fillies when foals are weaned. The udder of mare should be bathed in camphor dissolved in alcohol, and then well greased with lard. The mare should be closely noticed, after being turned away, to see that fever does not set in the udder. Each weanling should be provided with a well-ventilated box-stall (ten or twelve feet), and fed thrice every day when stabled or twice a day when running on barley paddock, mixing a little bran now and then with their oats or giving a mash to keep the body in proper state. In the spring the addition of a tablespoonful of ground flaxseed two or three times a week in a mash is very beneficial. Keep their stalls well cleansed, with good straw (wheat or oats) bedding. In one corner of feed-box keep a small box supplied with salt and hickory or cob ashes mixed, as the salt causes them to eat more hay, and this causes full bodies and proper shape of ribs. The weanling should be stalled every night through the winter. My plan of grooming the young animals (which I begin about 1st of April, preparatory to annual sale about May 1) is to place a ring at either side of the stall, about midway the side of stall; then have a stout cord, with snaps in both ends (this cord must be long enough to be a little slack when the snaps are fastened into the rings); pass this cord through the halter-ring of colt, and fasten snaps into the rings in side of stalls. The colt can slide along the cord, and as it yields somewhat to him it prevents the attempt to rear, which he would do if too unyielding. This arrangement—an invention of my own so far as I am advised—saves the expense of a hand when cleaning off the colts. The best mode for the breeder to dispose of them is to have an annual sale at some date between 1st of May and 1st of June of each year, and dispose of his entire produce without reservation or exception, and no by-bidding, at public outcry for cash.

The stallions should each have a paddock of one or two acres, well set in grass, and the exception should be to confine them to the stable; never have them shod unless you are using for saddle; a plenty of exercise and running out is the health of the stallion, enabling him to get stronger and better produce.

I offer here a few general remarks, by way of summary, on the art of breeding.

It is unreasonable to expect that our endeavors will, in every instance, be crowned with success. Perseverance seldom fails.

The breeder who selects his stallions with peculiar care, nice discrimination, and particular regard to pedigree, justness of proportion, size, powers, temper, constitution, and the essential qualities of speed and bottom, at the same time crossing the blood of his mares judiciously, endeavoring also to remedy the personal defects, deficient properties, and inferior qualities of the mare, by the beauty, admirable properties, and brilliant qualities of the horse, or *vice versa*, will be more likely to succeed in producing a beautiful and unexceptionable race of horses than the person who pays little or no attention to all or any of the particulars I have enumerated.

The breeder of any description of domestic animal must possess a thorough knowledge of the species of stock he is breeding, a decided taste and fancy for it, and a discriminating judgment. He must in the stock business, as in agriculture, be a student in all things that pertain to it, otherwise he will surely fail to accomplish the highest results attainable.

It is the interest of every breeder in forming a stud to purchase such mares as are free from all hereditary infirmities and have produced winners; and to select stallions which not only are of acknowledged celebrity on the turf, but which have proved themselves good stock getters. Speculative experiments may suit gentlemen of large fortunes, but the judicious breeder, aware of the expense which might be incurred, confines himself to the established practice of men whose experience and success in breeding render them worthy of imitation.

England has long been regarded as the nursery of the thoroughbred horse, but it must be gratifying to every American to know that our own country, through her plucky representatives, Mr. Pierre Lorillard and Mr. James R. Keene, have wrested from her the palm of excellence and superiority for 1881, and I may here add that European people are fast learning that America and Americans are irrepressible and invincible in all things that make a nation and people great, accomplished, happy, and that tends to individual prosperity.

In conclusion, permit me to state that a more suitable country than Tennessee is not to be found on the face of the habitable globe for the rearing of the blood-horse or any other breed of domestic animals. Indeed, Tennessee seems peculiarly calculated and adapted to the purpose of breeding and training horses for racing or the sports of the field; the purity, elasticity, and salubrity of the air, arising from its free circulation, the temperature of the climate being about the same latitude as his native country, Arabia and the Barbary States (36° to 37°), the luxuriance, sweetness, and variety of the herbage, the excellence of the water, quality of the grain, varied and diversified face of the country, short and mild winters, neither too cold nor too hot, are benefits which few other States or countries afford in an equal degree.

The PRESIDENT. The questions presented in the admirable paper to which you have just listened are now open for debate.

This paper, as you all know, was upon the "Blood-Horse," and is really an introductory to the whole question of horse-breeding in this country. Now, it certainly would be unwise in a convention like this—a convention of Americans—to stop short and deal with nothing but the blood-horse—an animal which is the result of importations into this country through a long series of years. As you have learned from this admirable essay, the ramifications of the blood of the blood-horse, in the various channels, are as important as that of the introduction of the horse himself.

Let me for a moment call General Jackson's attention to one point with regard to the horse with which he has been dealing, and I think it is proper to say it here, because it is a matter which should never be forgotten by those who are interested in breeding. What is called the blood-horse is known as a thoroughbred horse, and the term thoroughbred applies to no living animal except the horse. I hear gentlemen talking about thoroughbred Short-horns, thoroughbred Ayrshires, and thoroughbred Jerseys and Devons, and after the most careful investigation I have satisfied my mind that the term applies to horses alone, and constitutes a breed of horses which has descended from a family known as thoroughbreds, and are just as distinct as the Clydesdales, or any other breeds which have been kept distinct for centuries. The term thoroughbred is exactly like the term Norman or Percheron. But when you undertake to say that you have a thoroughbred Jersey, you simply misapply the term, and use the name of a race of horses to describe your cattle. You may have pure bred Jerseys and short-horns, but when you have a short-horn bull every breeder takes it for granted that that bull is recorded in the herd book, which ought to be an indication that there is little doubt about his breeding. I state this simply because I have ascertained from the best authority that this is right, and I am very anxious to see these terms as accurately used in our country as they are in foreign countries. Have, then, on our lists and programmes of agricultural societies no more thoroughbred Jerseys, for there are no such things on earth. Let it be Devons, or Jerseys, or Ayrshires, or Short-horns, and take it for granted that every honest American that brings his animals to the farm has back of the name a record in the herd book, and can show that, and let that be sufficient.

General Jackson has stated very properly that there is no such thing as a horse of all work; and yet there is a horse in this country so compact, so firm, so well-balanced, so wise, so sagacious that he constitutes for the farm what may be termed a horse of all work. True, he has not the qualities that have been inherited through long generations from animals that were high bred, but he belongs to a family that for generations has been toiling along side by side with his industrious and independent master until, like him, he has become a part and parcel of the great American industry. The American horse is really the most sagacious and well-balanced of animals; there is no violence or impatience about him; he stands until he is told to start. If he will not, he does not belong to that family which I am describing. While to that race which manifest their desire to start, the horse that you cannot hold when his head is turned in the direction he is to run, the horse that possesses the resolute determination to arrive first at the goal, is the thoroughbred, and this constitutes his value; whereas it is the mild eye, the perfect quietness, and deliberate action of the American horse that constitute his true value. Every man who understands how to break a horse knows that the first thing necessary to teach him is to stay where he places him until he orders him to go on.

This American horse, which is really a horse of all work, is not remarkable for his size, but for his intelligence and capacity and his strength, which is astonishing. The Scotchman breeds his Clydesdale for the heavy draft of the London streets. The Frenchman breeds his Percherons for the same purpose, and for hauling heavy omnibuses along the highways of France. They constitute very powerful and valuable breeds of horses, but I can take you into New Hampshire, Maine, Ohio, Pennsylvania, Michigan, and all along the northern line and find horses of smaller size whose vigorous organizations give them strength equal to that of their more ponderous brethren. It is not the size of a horse any more than it is the size of a man which constitutes his strength. It is not the size that constitutes strength, but the well-balanced, uniform, muscular animal organization, which, when called upon, knows where to apply strength. There was a small horse brought into the State of Vermont about a century ago, known as Justin Morgan, a fair type of the American. He was small. I doubt whether he was over fourteen hands and an inch high, and he never weighed over 900 pounds, and that was the horse which laid the foundation of that powerful race to which I have alluded. The holiday business of that horse was to compete in trials of strength at a dead-pull, and he could out pull any horse in the State of Vermont. It was that wonderful balance of power that gave him his strength. This is the style of horse that goes on hour after hour, in summer's sun and winter's cold, day and night, and is never weary. He is a good horse for the family. He knows exactly what he is expected to do, because for generations he has been engaged in that business to which Americans have applied him. It has been truthfully said that the American people use more horses than any other people on earth.

Every gentleman wants a horse for his family, and therefore wants one upon which he can rely. The American community is not a walking nor a riding but a driving community. They have used the horse in this way until he has inherited certain instinctive faculties which make him as easily taught as the American boy himself. Take the horse which has plowed all the morning and taken the family to drive in the afternoon, and you will find he has inherited for generations all that solid common sense which a horse will get as well as a man if he is taught; and there is no more trouble in breaking such a colt than there is in disciplining an intelligent boy. I have seen hundreds of these horses harnessed for the first time, and take to it as naturally as to the first quart of oats fed to them. That is the difference between the American horse and other horses that are not taught and used as he is.

As a member of this family there is that powerful animal known as the American trotting horse. He is not valuable because of his achievements on the track alone, but for all those qualities which make a horse useful and reliable. The trotting horse must be as steady on the track as the driver, and perhaps a little more honest. [Laughter.] He must know precisely how to manage himself, and must be possessed of all those muscular powers, that determination and will and deliberation which enable him tò succeed under all adverse circumstances. I have seen many a trotting horse fail utterly on the track, because his disposition was unfit for the struggle there. He was, perhaps, hot tempered, impatient under restraint, unwilling to contend inch by inch in the hardest possible way for the victory. We have a horse bred for the track, and when so bred he inherits all the traits valuable in a farm horse.

Mr. Jefferson said, and I wish that General Jackson had alluded to it, that the long stride of the thoroughbred would be felt at the plow on a long summer day. So, I say that the steady, even gait of the trotting horse, which our English and French friends recognize when they come to this country—that long, springing stride makes him good on the road, and one of the best work horses on earth.

Now, if you will examine the origin of the American trotting horse you will find that while the blood, wind, nerve, and strength of the thoroughbred horse lies at the foundation, it is the French blood that gives him his speed and stride. I suppose that to-day the best families of trotting horses are north of the latitude of Washington.

Some of the descendants of the best families of trotting horses south of the Ohio River can be found in Tennessee and Kentucky. The whole family of Pilots sprung from a horse known as Pilot, jr., a horse which has the reputation of having produced a large family of fast trotting horses; and Pilot, jr., was a Canadian horse. The Clays, another family of trotters, are descended from Surry, a mare that was sent from Canada into New Jersey. If you will examine the fine form and movement of the American trotter, you will see that it was the French blood that gave them their stride on the track, and the thorough blood that gave them their spirit and endurance. Unite the stride of the Canadian with the wind of the thoroughbred, and you will have the most powerful horse on earth.

I make these suggestions with regard to the trotting horse because he is entitled to consideration here, as a fine type of the family to which he belongs.

What General Jackson has said about the management of colts should not be forgotten. There are thousands of horses and foals wasted annually by neglect. We could raise a great additional number of good horses if the proper care were bestowed upon the foals and colts. The value of a horse bought in a Western market would be largely increased, if treated with more care under the rule General Jackson lays down. Take a car-load of horses from the Western farms, shipped before they have any knowledge of their work. They are all fed to great proportions, and before they have attained their full strength they are sent to market, assigned to work, and six out of ten are ruined in early life.

The breeding of many of these horses is admirable. Improved as they are by the admixture of Percheron and Clydesdale blood, they will undoubtedly be modified by climate and improved by the American breeding, until in the end they will constitute some of the best horses we have. Among them are American horses bred out of this admixture with the North American blood, and I think they will be so developed as to furnish us with some of our finest carriage-horses.

I trust I shall be excused for occupying so much of the time of the convention, and I shall listen with pleasure to the discussion.

General JACKSON. I am very glad we are on so broad a ground. I rise simply to correct an erroneous impression as regards the violent temper of the thoroughbred. While a spirited animal, as stated in my address, I have always found them the most sensible animals.

I have driven to my carriage a pair as gentle as any horses I ever used, and have seen them subjected to the most severe tests—in one case to the sight of a bull calf, with a tin-pail tied to his tail, coming down the street, bleating at every step.

The PRESIDENT. I did not mean that they were violent in their temper, only that they were impetuous.

General JACKSON. I accept the explanation of our worthy president, and agree with him in the facts he has stated with regard to their adaptability for driving horses. I do not claim that they are the best animal for driving. I agree in the views expressed by the honorable Commissioner, that these horses are most too impetuous for driving horses; therefore, the English have the correct view on this subject, even for their saddle-horses—a three-quarter blood-horse. These are the horses we have in the South for saddle-horses. I will state that much depends upon the training of the animal. You have doubtless observed where the deficiency or difficulty is. When the thoroughbred is heated on the race-course, driven back and forth before the heat, he has been given too much work, and when brought up there is an indisposition and fretfulness at the starting point; but show me the animal that has been carefully and properly handled upon the track, and how differently he approaches it, and how quickly he shows the result of proper care.

Dr. **Loring**. Have not those horses been the most successful on the race track?

General **Jackson**. Yes, sir; let me see the animal controlled by excitement, starting, and exhibiting a kind of shakiness, and I know that that horse cannot win a race or a heat. What wins is a quick, well mannered horse that moves in a quiet way making no pretensions; that is the dangerous horse. I have seen a horse awaiting the start not moving from his position, not casting his eye either to the right or the left, and moving up quietly and off at the tap of the drum and not before. There is a great deal in the training of the horse. I feel that this was the case with the horses got by Missouri. He did not produce the best racers, and I believe that the produce derived much of their nervous disposition and their fine knee action from him, and this has made them such valuable trotting horses. There is no gentleman who admires the American horse more than I do; but it is a cross of the thoroughbred stallion upon the trotting mare that influences that blood in the produce, which is so much needed to quiet the temper of the animal, and give that knee action indispensable to the trotting horse. That is the true course in my opinion. So far, we agree in that idea. I have most valuable strains of it. The blood of that strain we have in my country, we date back to the American horse, Pilot junior. I prefer myself for driving while not wanting so much speed, an easy gait; 2.40 suits me. I do not care so much for speed. I prefer a little more beauty in my driving horse. I drive a three-quarter bred horse, a gentle animal, having a speed of about 2.40; if he was to see a locomotive standing in the road he would not fear it. He is spirited, but yet gentle. These horses have more of the motion of the roadster in my opinion than any others.

I value highly the American horse, but I do not like them for the track. I want a short clipping motion, which never produces the oscillatory motion in the buggy like that of a bucket swinging in a well, but like that which the locomotive gives to the train. Any length of stride that swings you in the buggy or gives a side motion to the buggy, is very repugnant indeed to me. But I want a driving horse with a motion like that of the locomotive. I have found, as I have stated, that the cross with the thoroughbred produces a roadster having a much preferable gait to the trotting horse. I am gratified to know that we have a distinct breed of American horses. They are very useful, but I still doubt the correctness of the claim that the American horse is of more value for a greater variety of uses than the thoroughbred. Most of our people who have horses will tell you that the blooded horse makes the best plow horse, the best child's pony, the best harness horse, and the best horse of all work.

The **President**. I have not forgotten the value of the thoroughbred, and know what a fine work he performs, and that but for the early introduction of such strains of blood as that from Messenger we should never have had these valuable animals, which have elevated our horses to so high a position on the race course. I have alluded to the old horse Messenger, and I could show further, that when brought into Pennsylvania he produced no trotters who became fine racers, but when removed to Long Island, and along the northern line where French blood was found, he laid the foundation of the most remarkable trotting horses that have ever been in this country, and that is the value I place upon this blood.

Mr. SAUNDERS, of Illinois, said: I desire to speak briefly in reference to one point you raise in your remarks. It has been very common in this country to ascribe all trotting excellence of our American horses to one single thoroughbred horse, the Messenger. In writing a good deal on that subject I have become most thoroughly convinced of one point, to which you have alluded, and that is that the outcross of French-Canadian blood, wherever used with thoroughbred strain in our country, has always produced the best quality of trotting horses, and I attribute it to this mixture. It is this same French strain and mingling which produced Morgan and Pilot and Copper Bottom. The mare Surry was an outcross on Henry Clay. We found no trotting excellence in Kentucky until they obtained it from the Pilots and Copper Bottoms. In reference to the term thoroughbred I must beg leave to differ slightly upon that point. I believe that all good horses are entitled to the term, but it has become quite common, even in England, to use it in other connections. Its use during the past ten or twelve years has increased wonderfully. You will find it in the best papers in England. Language changes as we advance in civilization, and it is now common to use the term thoroughbred as synonymous with purely bred. You will find it in the very best English papers—the Mark Lane Express, English Agricultural Gazette—the terms thoroughbred Jerseys, Devons, and Ayrshires. As a rule it may be well to confine the term to horses, because it is the name of a breed of horses, and never should be applied to horses excepting "blood-horses," but, as I say, it is used as synonymous with purely bred.

The PRESIDENT. I had occasion once to define the name thoroughbred, and my impression is I consulted a book known as "Stonehenge on the Horse," for my information. I am perfectly aware that the practice is usually as Mr. Saunders says, and I think it would be a good example to set our English neighbors, and a very good way of helping them to realize that we understand ourselves as well as they do, to let the thoroughbred horse go for a breed of horses, and wherever the name Ayrshire or Jersey is applied, use it as such. If necessary to magnify it put "pure blood" at the head of it.

General JACKSON said: I do not wish to trespass on the time of others, but I would like to say one word about your reference to George Wilkes. When in Kentucky, he was regarded as a failure. I would state that in breeding the blood-horse, that it has been found, and England herself has come to the same conclusion, that this blood is impaired in the different sections of the country by breeding too closely in-and-in. There is the trouble, and the judicious crossing of the trotting horse and the other is very necessary. Take the thoroughbred Lexington. He was a successful horse on the turf, but in England was regarded as a failure, yet now has a peerless representation, and he got as valuable colts as any horse imported. Numerous instances show that it is dangerous to keep the same stock without bringing in a dangerous tendency.

The PRESIDENT. I am very happy to have been able to give General Jackson the floor first this morning, on account of the importance of the subject of which he was to speak. I feel compelled, however, to suggest that there are two or three other essays to be read and discussed, especially a valuable article by Mr. Morrow. Shall the convention hear the essay of Mr. Morrow?

Mr. SARGENT. There is upon the table a report of a special committee. I move that it be taken up.

The PRESIDENT. The report of the committee charged with the consideration of the question of co-operative experiments will now be read.

The report was read, as follows:

The committee charged with consideration and report upon co-operation in agricultural experiments having deliberated upon the papers which introduced the subject to this convention, and the discussion which resulted, respectfully submit the following report:

The value of agricultural research and experiment in America is fully admitted, and the extension of this work is recognized. With this growth arises the liability of a waste of time and materials through unintentional duplication of experiments by different parties, or such difference in details by those conducting similar lines of investigation, as to prevent satisfactory comparison of results, and the great need in other cases of conducting certain experiments in different localities upon a common plan.

Evils may be avoided on the one hand, and benefits secured on the other by the inauguration of some system of co-operation.

As a guide to these labors, comparatively new to our country, many institutions ready to participate need concise information, not now within their reach, as to similar experimentation abroad, and its results. It is therefore suggested by this convention, through the adoption of this report, that the United States Department of Agriculture may perform a service of great value in promoting the science and practice of agriculture in this country, by an effort to meet these wants. To be more specific, it is suggested—

1st. That the Department of Agriculture might furnish to all engaged in agricultural experimentation in America a well prepared digest of the work of this character, accomplished at the best stations of foreign countries, either as a part of the annual report, or, preferably, in a separate and earlier publication.

2d. That the Department of Agriculture might take measures to become the medium of communication between all parties engaged in systematic agricultural experimentation in this country, and endeavor to secure general co-operation in this work, especially the prosecution of certain important investigations in a number of different localities after a carefully prepared plan. Some of the questions suggested as of special interest, and to which general attention has already been directed, are the following:

The nitrogen supply of plants.
The various compounds of phosphoric acid.
The composition, nutritive value, and adulteration of foods.
These are in the line of exact science. and as practical tests.
The economic preparation and feeding value of ensilage.
The improvement of land by the plowing under of vegetable matters.
The adaptation of useful plants to arid regions.

3d. That the Department of Agriculture, acting for this convention, be requested to bring this important subject to the attention of Congress, and apply to that honorable body for the necessary means to carry out these suggestions, including such aid as it may seem best for this department to extend to those now unable, for want of funds, to engage in this work.

The suggestions of this report are not intended to conflict in any way with the independent action of institutions prosecuting work of this character.

J. M. McBOYD,
University of Tennessee.
G. C. CALDWELL,
Cornell University, New York.
W. O. ATWATER,
Connecticut Board of Agriculture.
A. A. SARGENT,
California State Board of Agriculture.
HENRY E. ALVORD,
Houghton Farm, New York.

The PRESIDENT. The chair desires to say that every suggestion made here is in entire accord with the wishes of the department, and are in the line of some inquiries made by the department which have been successfully instituted. Under the available appropriation an expert has been sent to Europe to examine experimental stations, the report upon which will soon be submitted. I assure the convention that in so far as I am supported by Congress everything possible shall be done by the department to bring the reports of the colleges into immediate connection, in order to give the country the valuable information obtained therefrom. I am especially anxious to do this, and it is gratifying to know that the colleges themselves are willing to co-operate with me.

Mr. SARGENT. I would like to say, in behalf of the committee, that we were well aware of the enlightened labors of the present Commissioner, and our efforts in preparing the report to carry out the objects of this assembly was to strengthen the Commissioner's hands, and by our indorsement, if it were necessary, show to Congress that we do consider his labors as enlightened, and thus fortify him in his request for appropriations.

The report was adopted.

The PRESIDENT. There is a special committee ready to report, and as it will consume but a moment, the convention will receive it now.

The report was read, as follows:

The committee to whom was referred the request of General Ruggles to take into consideration a process invented by him "of composting manures and fertilizers by steam for agricultural uses," "and to report whether, in their opinion, it would be advisable that the subject be experimented upon by agricultural colleges as a basis of instruction in the interest of agriculture," beg leave to submit the following report:

That they find by consulting the circular of the inventor that the process has been patented, and that it cannot, therefore, with propriety, be considered or recommended by this convention.

D. B. GILLHAM.
JNO. L. BUCHANAN.
HENRY CLARK.
D. WYATT AIKEN.

The PRESIDENT. The convention will now listen to an essay by Professor Morrow upon the "Animal Industry of the Central West."

ANIMAL HUSBANDRY IN THE CENTRAL WEST.

BY G. E. MORROW, *Professor of Agriculture, Illinois Industrial University.*

To include a vast territory under the term Central West—even from Ohio to Kansas, or Nebraska, with the southern boundary cutting off not more than a single tier of States—will not be considered inappropriate when we bear in mind the magnificent extent of our national domain. In this region animal husbandry—the breeding, rearing, feeding of live-stock and the production of live-stock products—is already one of the most important branches of agriculture, and is to become vastly more important in the years to come.

Almost all the reasons which make the domesticated animal so important a factor in nearly all successful agriculture are applicable to the agriculture of this region. Here, as elsewhere, the farmer finds in stock raising the opportunity for profitable labor and oversight throughout the year; the most practicable means of preventing the waste of land and partial waste of by-products almost irreparable from most classes of exclusive plant cultivation. He finds in it the most effective prevention of deterioration of the fertility of the soil. His animals enable him to retain on the farm a large part of all his plant crops have taken from the soil. Their presence makes it his interest to adopt a beneficial rotation of crops, and to cultivate those best entitled to the name restorative as contrasted with exhaustive. They enable him to produce on his own farm a fertilizer unequaled in its wide application by any product of the skill of the chemist—barn-yard-manure—the best type of a complete fertilizer yet produced. During a good part of the year, his animals do what no other fertilizer manufacturers propose; they not only manufacture the manure, but apply it in a satisfactory manner to the soil where needed, making no charge for the labor, and doing full work in the manufacture of valuable products for sale. They enable the farmer to secure larger returns, and, probably, greater profits from a given area of land as the result of the greater labor and skill which they and their products require, as contrasted with grain-growing. Animal products are, in condensed form, valuable in proportion to bulk; hence are better fitted for transportation to distant markets than are the more bulky grain products. This condensation of the surplus farm products is one of the best safeguards against great loss from excessive transportation charges.

All these reasons apply with especial force to the agriculture of a nation like our own, which must necessarily be a large exporter of agricultural products. To no part of the country are they more applicable than to the Central West, which is to furnish the greater part of the agricultural material for export, and, in the near future, is to supply much food to the thickly populated East. With a soil admirably adapted to the economical production of grains and grasses, and a climate well suited to the healthful and luxuriant growth of both plants and animals, the Central West has laid upon it the desirability of condensing agricultural products because of the great distance of the markets to which they go.

It is pardonable pride with which we speak of the marvelous rapidity of advance of American agriculture. The exportation of agricultural products may be said to have begun within the memory of men now living. The magnitude of these exports we can scarcely realize. Rapidly as they are increasing, the exportation of live-stock products is increasing, perhaps, most rapidly of all. We are to send largely increased supplies of breadstuffs to Europe; but the increase in the quantity of our animal product exportation is to be still more rapid.

Probably, in no country and in no age has there been equally rapid advance in agriculture with that seen in Western States within the last quarter or third of a century. Within a few years, States have grown from sparsely settled regions barely supplying the wants of the few inhabitants, to be mighty empires in population and producing power; and in no field has the development and improvement been more rapid than in the live-stock interests.

To one who had the pleasure and profit of studying the largest collection of fine farm animals ever made in Great Britain; whose admiration for the mother country swelled within him as he carefully examined the imposing array of animals shown at London in 1879, and who also looked at corresponding collections at exhibitions in our Western States a few months ago, there came the conviction that, as a whole, the American exhibits were better than the British; for not only had American importers secured leading prize-winning animals from Great Britain, France, and Holland, but, side by side with them were American bred animals, their full equals in many classes, and in some cases their superiors.

Not to unduly extol one portion of our common country over another, but because it was in accordance with the plans of nature, the belief is stated that the Central West is to be, for years to come, the region in which is to be produced the greatest number of high class farm animals of most classes.

The vast importance of the live-stock interests of the farther West, Southwest, and Northwest, is fully recognized. But until existing conditions are changed it is evident that quantity rather than high quality most characterize the animal products of these regions. The stock-breeders of the father West will continue to look to the Central West as the nursery ground from which must come the chief supply of high-class breeding animals as a means to the gradual improvement of their own stock.

Almost every section of our country may wisely give increased attention to some class of live-stock production. Especially would I be glad to see millions of acres of land, now almost unproductive, made the home of vast flocks of sheep, even if this led to the fine wool sheep being almost driven out of the Central West. Milk production must receive increased attention in the farming districts comparatively near the great center of population on the Atlantic coast. And I hope the time may soon be that our Southern States will have no need to import any live-stock products.

But in the greatest Indian corn producing region in the world; where also the forage grows thrice as well as anywhere in the United States; where the climate is alike free from excessive and long continued cold and dreary periods of oppressive heat; where the rainfall is usually frequent and plentiful, we have unequaled facilities for meat production, and all these facilities exist in much of the West. In the northern portion of the Central West there are districts far larger than all the dairy regions of New England and New York, which are almost unequaled for economical production of dairy goods. The present product of butter and cheese in the West is very large; the annual increase is great, and this increase is to continue for many years.

Much has been done in many ways to help the live-stock interests, but much remains to be done. In the work thus far done in agricultural experimentation in this country the soil and the plant have naturally had chief attention, but in breeding, rearing, feeding, and management in health and disease, of our domestic animals, many unsettled questions confront us, and for their solution we need the aid of the scientist, as well as that of the intelligent breeders.

If it be important to determine how best to utilize the food for plants found in the soil, none the less important is it to learn how most economically to utilize the plants as food for animals; if it be important to improve, modify, produce varieties of plants, so likewise of animals; if it be deserving of attention that better modes of manufacturing vegetable products be wrought out, equally true is it that like work needs to be done for animal products; if the prevention and cure of diseases of plants be a worthy subject for patient investigation by the scientist, the suffering animal has at least equal claims to relief.

In these fields—not alone for the West but for the whole country—there is room for work by all whose attention can be enlisted. I am glad to know it is the purpose of the distinguished chief of the Department of Agriculture to give increased attention to these matters. It was a cause of regret to me that the discussion of the work of agricultural colleges left no time, in the convention preceding this, for even a word of recognition and commendation of the work already done in many lines by State and district agricultural societies. By their published reports and their annual exhibitions, these societies have done very much for agricultural progress. The growth of the American dairy system has been greatly assisted by the dairy associations. The agricultural exhibitions have been the most effective means ever devised for making the masses of farmers familiar with the various breeds of animals and causing the wide spread of the improved breeds throughout the country. Many of these societies are widening and making more effective their work. To the State board of agriculture of a Central West State, Illinois, belongs the credit of having instituted and placed on a secure basis the most instructive and interesting live-stock exhibition of the country, the annual fat stock show held at Chicago.

The fairs, special, agricultural, and general, has done good work in their lines, and is ready to do more. Many a farmer's boy has been incited to a desire for better live stock by what he has read in his agricultural paper.

Valuable experiments have been conducted or are now in progress at our agricultural colleges to determine unsettled questions in stock breeding and management. At the Illinois Industrial University, for instance, in continuation of work already done, lists of the comparative progress of cattle and pigs of all attainable breeds will be made.

The general government has given aid to special investigations of diseases, and has attempted legislation in aid of the live-stock interests. Except for a single animal product, American farmers have not asked for any other "protection" by law, than protection from disease, disease imported from foreign countries, from neighboring States, neighboring counties, or neighboring farms. No arbitrary or unnecessary restrictions are desired. Insisting that the herds of the Central West are free from contagious disease, it is asked that they may be permitted to remain so. I hope the time may soon come when all restrictions on importations from Great Britian may safely be removed, just as I hope we may soon be able to leave the British authorities without excuse for not removing all restrictions on exportations from this country.

Among vitally important questions to which too little attention has been given, may be named the adaptation of different parts of the country for the profitable production of different classes of animals and the comparative merits of different breeds for varying purposes and conditions.

Rich stores of valuable animals have been imported, but not enough attention has been given to distributing breeds with reference to their adaptation to special climates and conditions. It cannot be true that cattle from the plains of Holland, the Channel Islands, the south and the north of England, the lowlands and the highlands of Scotland, are equally well adapted for any one region, yet in some Western States there are enthusiastic breeders claiming special superiority for each one of these breeds. It is hardly in accordance with the self-assertion and confidence charged as characteristic of Americans, that we have not only been content to import foreign breeds, but, with rare exceptions, have held the types of those professed in their native lands to be the best for all our widely differing circumstances. Modification of breeds to meet special wants seems more needed than additions to the number of distinct breeds. Multiplication of breeds may be an evil. Certainly it is not sufficient reason for importing a breed to this country that it has been found useful or ornamental in another. For illustration, it is proposed to import to this country the West Highland cattle of Scotland. I have admired the picturesque appearance of these cattle in their native country; their stately horns, shaggy coats, as also their evident good meat; but I do not know where nor for what purpose they would prove more desirable in this country than breeds we already have.

I fully appreciate the heavy draught horses from Great Britain and France, but I do not believe the most popular types in those countries are the ones best fitted for the requirements of our own country. With hearty appreciation of the merit of the almost cosmopolitan short-horn, I cannot admit it is the best breed for all parts of the West. It seems quite possible it will be best to so modify some of the mutton breeds of sheep that the word American may as properly be prefixed to their names as it is to the Merino. Of swine, one of the very best breeds is the product of crosses and selection made in the West.

So, throughout the West, we need to better classify and distribute breeds. The central belt is admirably adapted to the production of the heavy draught and "the general purpose" horse; of the larger of the distinctive beef breeds; of the Downs and Combing wool sheep, and of the larger breeds of swine. The more northern belt is naturally better fitted for the dairy breeds of cattle, especially those of northern origin for the lighter breeds of horses and sheep. In the southern portion will probably continue to be the chief center for production of the blood-horse, and perhaps of the trotting horse, while the meat-producing breeds will also thrive well.

There is a wide field for needed instruction concerning the characteristics of breeds, and the fundamental principles of breeding. It is unfortunately true that there are many American farmers to whom the principles of breeding and improvement of live stock are utterly unknown, and who use the term "improved stock" as an exact synonym for "fancy stock;" honestly believing that the improved breeds are of direct interest only to wealthy amateurs, or to speculators in agricultural matters.

To popularize the results attained by the most skillful breeders is a needed work. We may best do this by proving, in practice, that the so-called improved breeds deserve the title, because the produce for us, at equal or less cost, more or better meat, wool, milk, or work, than do the common breeds. In so far as we give chief attention to practically useful qualities rather than to those which simply appeal to the eye or to a sentiment, we aid in this work of popularizing fine stock.

In wise and ready adaptation of methods to the circumstances is found the secret of successful agriculture in any region. I grow more and more strongly to believe that the opinions and practice of intelligent and successful farmers are better adapted for their region and circumstances than are the opinions and practice of any other locality. It illy becomes us of the West to criticise the methods of the East, and possibly words of criticism of Western methods have been unwisely spoken or written by Eastern farmers. But the average farmer is overly conservative. He does not always quickly perceive the changing conditions which demand change of methods. It is important that this Department of Agriculture, the press, the agricultural societies, and the agricultural colleges help to the readiest appreciation of these changes.

In the West changes of conditions come with marvelous swiftness. The ruder, simpler methods of the past are often no longer applicable. The farmers of the Western States are in competition not only with those of the East, but with those of the civilized world. The enormous additions to the agricultural producing class each year is rapidly filling up the low-priced lands of the West. The rate of advance in price of land is less rapid as the money-value becomes larger; so that farmers in many parts of the West can no longer look to the rise in the selling value of their lands as the chief source of profit, but must look to profits from careful husbandry.

Greater economy of production, rather than the production of the greatest possible quantity, is coming to be the chief question for American farmers; and the more economical production of live-stock products is already in the front rank of the important problems confronting the farmers of the Central West.

Mr. JACKSON, referring to the point in the paper as to the danger of taking the teachings of one section of the country and applying them to another, stated that in his opinion the agricultural journals should be collated for the latitude they are designed to serve. While in one section the object is to make the most per acre, in others labor being the principal cost of production, and having an abundance of land, the object is to make the most per hand; therefore it is dangerous to apply the teachings of one section to another.

The PRESIDENT. The question is still open. The chair will state that in the last Congress appropriations were made in various ways for investigating all matters touching the diseases of cattle. A liberal sum was appropriated, and an efficient agent has been at work for the purpose of ascertaining whether any diseased animals had been shipped from this country to Europe. This department had a considerable amount of money, and their agent obtained full proof that no contagious *pleuro-pneumonia* had gone abroad. They have not modified their law, but their opinions, and the difficulty to obtain suitable legislation in Congress in this country is greatly enhanced by the number and variety of the constitutional questions involved in its consideration. My experience is that the members of the Senate and the House have been earnestly and liberally disposed to provide means to prevent the spread of such diseases in this country, and to remove the impression that they are neglectful of so important a matter, it is an act of justice that I should state that these are the views of some of the most efficient gentlemen in that body.

Dr. ELZEY, of Virginia, referred to the matter of transportation as dealt with in the paper, and expressed his surprise that they have in the Central West expostulation, legislation, and denunciation, as against railroads in that section. Twenty days previous he had been told by a proprietor of a feed-store in Alexandria that every article upon sale in his store, without an exception, came from the Central West because of the question of transportation; that transportation on those articles from Chicago to Alexandria was less than from 30 and 40 miles distance in the neighboring section of Virginia and Maryland. It costs 12 cents a bushel for wheat from Chicago to Liverpool. I live within twenty-six miles of Alexandria, and within four miles of the railroad depot, and 12 cents a bushel is what it costs me to send wheat to Alexandria. [Laughter.]

Dr. Elzey spoke of the difficulty surrounding the several industries, because of this question, and referred at length to the subject of fertilizers, and the exhaustion of the soil. He then dwelt at length upon the diseases of live stock, and the importance of action on the part of the department and Congress relative thereto, and closed by offering the following resolutions, and moved that a committee of five be appointed to present the same to Congress, and to report to the convention:

Resolved, That this convention, profoundly impressed with a sense of the danger which threatens one of the greatest of our agricultural interests, from the continued existence of lung plague or contagious pleuro-pneumonia of cattle in the District of Columbia and several States of the Union, do most earnestly and respectfully urge upon Congress that they will consider the propriety and necessity of national legislation in aid of such proper and effectual measures as those States, or any of them, may adopt for the complete suppression of this fatal distemper.

Resolved, That we do most earnestly and respectfully represent to Congress the urgent necessity for prompt and effectual measures for the complete suppression and extinction of this plague in the District of Columbia.

Resolved. That this convention are assured that the present status of this plague cannot be suffered long to continue without its becoming widely diffused and permanently naturalized here; and that such a result can only be viewed as a stupendous and far-reaching national calamity.

Mr. SAUNDERS. The question here is certainly one of great difficulty and of vital importance. There are one or two other points in the Morrow paper I would like to hear discussed, but I will move that as the hour has arrived for adjournment, that we now adjourn, and that will give us a little time to think of the resolution and continue the discussion of the question at the afternoon session.

The PRESIDENT. The chair would suggest that the logical order would be to let the resolution be adopted, and then you have something to go upon.

The resolution, as offered, was adopted.

The PRESIDENT. The chair will announce the committee at the afternoon session of the convention. The time has arrived for adjournment. At the afternoon session, the first essay should be presented by Mr. Campbell Brown, of Tennessee, on "Jersey Cattle."

Mr. JACKSON. I have been informed that Major Brown will not be able to attend the meeting.

The PRESIDENT. There is an announcement of an essay upon sheep, by Mr. Cockerill, of Tennessee. Will he be present?

Mr. JACKSON. I do not know.

The PRESIDENT. Then the essay will be that of Professor Law, on Veterinary Science.

The convention then took a recess until 2 p. m.

The convention was called to order at 2.20.

The president announced the following committee upon the resolutions offered by Mr. Elzey, viz: Messrs. Elzey, Law, Saunders, Morrow, and Aiken.

The **President**. The first business this afternoon is an essay upon Veterinary Science, by Professor Law, of Cornell University.

Professor **Law** first referred to what veterinary science had already accomplished. Formerly Europe was devastated by rinderpest with a loss of 20 to 50 per cent. of cattle—in some places more, some less. Now, apart from general wars, it is virtually unknown in Western Europe. Formerly sheep-pox ravaged Europe generally, producing a mortality nearly equivalent to that of rinderpest among cattle. Now, by efforts of veterinary science it is little known out of the Russian steppes. Formerly lung plague was a constant menace in Central Europe—extending from the mountain ranges where different herds of cattle could mingle freely and perpetuate the contagion—now, comparatively, there is none apart from the great channels of trade and the gigantic feeding establishments.

Rinderpest was introduced into England in 1865, and increased owing to neglect of restrictive measures until 1866, when the attacks amounted to over 13,000 weekly. The disease was then taken hold of, active measures were introduced for stamping it out, and in a few weeks a very material and satisfactory reduction of the losses was manifest, and within a year it had virtually disappeared from the country. During this outbreak the losses were nearly $50,000,000. The year previous sheep-pox entered from Europe with some imported sheep. It was introduced upon the downs of the midland counties. It was at once arrested by prompt destruction of the sick in infected flocks, and there was saved at a small outlay a loss that might have aggregated $100,000,000.

Lung plague has cost England in forty years considerably more than $500,000,000—which might have been saved by application of proper measures at the early stages of the disease. The free trade in continental cattle has maintained this plague in England in the past, and even now when measures are being taken to suppress it these are too loose to afford protection at every point. While England shuts out all cattle from foreign countries infected with lung-plague, not admitting them even under quarantine regulations, she admits from infected Ireland cattle without question into her native herds. England affects to destroy all animals diseased, yet in case of animals in transit only the sick are slaughtered and those that have been in contact with the sick are allowed to pass on to their destination, and therefore England should not expect any extinction of the plague. She is simply adopting repressive measures. In connection with this loss we might consider the present agricultural depression. This is not mainly owing to cattle disease, yet contagious diseases in cattle did much to undermine this industry which has been now brought to the verge of ruin by American competition and unfavorable seasons. In contrast to this, Professor Law quoted the countries from which contagious pleuro-pneumonia had been stamped out—Norway, Sweden, Denmark, Switzerland, and others, and in our own country, Massachusetts and Connecticut. In connection with the former the speaker mentioned Dr. Loring and Dr. Thayer, and with the latter ex-Governor Hyde and Mr. Gold. This he considered triumphs of veterinary sanitary science.

Referring to anthrax—known under many different names—Professor Law said it was an infection shown by veterinary investigation to reside especially in swampy localities, river bottoms, and the like. It is especially a disease of close, impervious soils—of those that are rich from the amount of organic decomposition, although they are not so close in their texture; yet in their organic decomposition, whether from the vegetable products of the soil or heavy manuring. It is also found to a certain extent on "water-logged" soils. Anthrax is due to a microscopical parasite—the *Bacillus anthracis*—which bears a close resemblance to the *Bacillus subtilis* of old hay, but the *B. subtilis* introduced into the system did not produce any of the pathological effects of the *Bacillus anthracis;* yet investigations were set on foot to determine whether or not they were not the same. Dr. Greenfield, of London, made the first essay, and Buchner, following, demonstrated that the one could be transformed into the other by growth in particular media. These investigations suggest the possibility of harmless germs lying around here and everywhere being transformed under certain conditions of climate, moisture, &c., into those that are pathogenic; but on the other hand it suggests protective inoculation with the mitigated virus of anthrax to fortify the system against a second attack of this disease, as cow-pox proves protective against small-pox. By cultivating the germ of malignant anthrax in free air you obtain a germ the products of which are not deadly, or which cannot grow in the system with such vigor as to be in itself mortal to the subject inoculated. The germs that live in the animal tissues, or the blood, can only get a limited supply of oxygen, and feeding upon that become more and more accustomed to it, and therefore become more and more virulent, reproduce themselves in greater numbers until they become deadly poison, while originally they were comparatively harmless. Poison which has once grown in the animal system, man or beast, if transferred to another animal is immensely more potent than in the first. So we have an adaptation of poisons to the conditions of life in which it finds itself. At first it demanded a great supply of oxygen. It could not live, vigorously, away from it. Transfer it into the blood, and it maintains a somewhat sickly life, all the time acquiring, however, the habit of living with less and less oxygen. Transferred to another system it gains a little more. In the third still more, becoming all the time more and more deadly.

Professor Law described at some length the observations of Pasteur and Salmon in chicken cholera, and his own on hog cholera, all sustaining the same general principle that the *bacteria* of these diseases become more or less virulent, according as they have been previously grown in media approximating in composition and supply of oxygen to the conditions they meet with in the animal fluids and blood. Also the converse that these *bacteria* can be cultivated in such environments that their virulent properties are modified, and they produce only a mild and non-fatal disease, though still protective against a second attack of the same malady.

He proceeded to trace the operation of the same principle in the case of typhoid fever, the germs of which are most deadly if confined in an unventilated sewer or privy vault, if they leak into a close well or soak into a dense water-logged or filth-sodden soil, but are soon rendered harmless if thrown out in thin layers on the surface of the soil and in free air; also in the case of cholera, the germs of which are preserved indefinitely at a summer temperature in well-water, rivers, filth-saturated or sodden soil, and those with a high-water level, but are rendered completely harmless when exposed in thin layers to the air for a period of six days; also in yellow fever, the germs of which attain their most [illegible]dly potency when confined in closed ships' holds, or ships' wells beneath the valves, in water-soaked and putrid soils, in sewers and stagnant ponds, whereas drainage and exposure to pure air puts an end to the virulence; also in the cases of diphtheria and croup, which prove more or less deadly according as the germs develop on the air-passages and in free air, or on the alimentary passages where the stagnant air, or the comparative absence of air, adapts the germs for survival or reproduction in the blood and animal tissues. The same holds in the case of septic poisoning, the putrid matters when inoculated producing oftentimes but a mild disease, but transferred from the first infected animal to a second the resulting disease proving much more severe, and if inoculated from the second infected animal on a third, and from the third on a fourth, it attains its most destructive potency only in the fourth or fifth system. Again, Grawitz has shown that several of our common molds, when grown under the surface of an organic infusion, are propagated in the form of simple cells only, and not as branching plants, and the isolated cells introduced subcutaneously into the animal system produce a fatal disorder. Underneath all is the general law that the growth of these low vegetable organisms—*bacteria* or *fungi*—in a limited amount of air, fits them to maintain a vigorous life in the animal fluids and to produce disorders more or less fatal in character. But the same law, working in a reverse direction and transferring the fatal virulent germs into a form which demands a liberal supply of air for their active life, and one unfitted for survival in the blood or tissues, furnishes us with a poison which may safely be inoculated, and which will fortify the system against any future attack of the same poison.

From the above premises Professor Law went on to draw the following deductions: That *bacteridian* disease-germs are preserved and their virulence intensified by close buildings, rotten wood-work, accumulated fodder, and other contents of the barn, overcrowding, close drains and sewers, cesspools, close spaces beneath stables into which liquid manure drops, close, undrained, non-aerated soils (clayey, hardpan, water-logged, manure-laden), wells receiving surface drainage (especially covered wells in compact soils). That the same *bacteridian* disease-germs have their virulence, though not necessarily their vitality, destroyed in clean, airy buildings, on the surface, in free air, in open wells, ponds, and rivers, in chalky, gravelly, or other pervious soils when sufficiently dry, and in soils subjected to frequent plowing in connection with cultivated crops. In the case of graves, when the infected carcasses have been buried, it is imperative with certain of these diseases, such as anthrax, that they should be thoroughly fenced in for years.

Referring to lung plague of cattle, Professor Law set forth at length the relative advantages of dealing with this disease by protective inoculation, and by the more rigorous stamping out by slaughter and disinfection. Fully acknowledging the protective influence of inoculation, he showed the dangers when it was resorted to of extension of the disease by sound animals taking into their lungs the germs from the inoculation wound, either directly or after such matter had been dried up for a length of time in buildings, &c. He showed further that inoculation, never having proved effectual in permanently stamping out the lung plague in any country, situated as we are, we could only look upon it as a means of restraining the disease and mitigating the losses, while its extension to the sources of our cattle traffic, and its general diffusion, would remain possible at any time. Such extensions would demand the adoption of inoculation over the increasing area, every new herd inoculated becoming, for a time, with the buildings, &c., a new center of infection, the dangers of diffusion of the plague would be proportionately increased. Then the cost of inoculating over 40,000,000 cattle would cost not less than $4,000,000, while the half of that sum judiciously applied would extirpate the disease from the land, and free us from the danger, except from its reimportation. Inoculation would have to be repeated as often as new stock were introduced by birth or otherwise, whereas a complete stamping out would prove effectual for all future time.

He went on to state the difference of our relations to lung plague, and to the other contagious diseases of animals. Texas fever, anthrax, chicken cholera, and swine plague are already so widely spread in the United States, or so permanent in certain soils and districts that they cannot be approached with the same confidence of a speedy extinction as can lung plague. Again, several of these demand for their extinction such modifications of the soil by culture, drainage, and otherwise that the task of stamping them out would be a far more trying one than the extinction of lung plague. Lung plague, on the contrary, is confined to a very limited area, and apart from the infected cities to inclosed farms, from which it could be certainly and permanently crushed out. Lung plague now costs us $2,000,000 per annum on our exports alone, and probably a million more of incidental losses at home. No country invaded by this disease has ever been offered a fairer opportunity to stamp it out, and to no country will so much blame attach if it is allowed to spread until we count our losses by scores of millions in place of units.

On these considerations it appears highly important that Congress should be urged to grapple with the plague promptly and earnestly, and that whatever appropriation is made for the extinction of this affliction should be ample, and should be made applicable to this plague alone. If an attempt is made to deal at once with all our animal plagues any sum appropriated by Congress will soon be exhausted, the work will have to be stopped prematurely, and this and other plagues will be allowed to spread around. The prompt and thorough extermination of lung plague is demanded by considerations of political economy. Much less than our present yearly losses from this disease would suffice for its final extinction, and these bear no relation to the immense losses that must follow its general diffusion. The moral influence to be secured by the extinction of this plague is needed to incite Congress to advance to the extermination of our other animal plagues. On the contrary the initiation of work upon all the plagues of our live stock, and the failure to exterminate any one of them, until the time and means have been exhausted, will only serve to secure charges of no good results, denunciations of all kinds, and a hesitancy or refusal to proceed further in the matter. This is really what has happened already in several of our infected States. New York had stamped the lung plague out of six counties, and would have done so in all, but that local prejudices and politics in Brooklyn were allowed to set the State law and officials at defiance, and finally, when on the strength of a new appropriation preparations were being made to face and conquer the difficulties of the situation in that city, orders were received from Albany which virtually enjoined the cessation of all effective work, and since that the plague has spread in four counties which were virtually clear. Pennsylvania, which began well with a most liberal system of indemnity for animals killed, which enlisted the stock owners themselves in the interest of ex-
tion, never succeeded in the essential measure of establishing sep-
markets for sound store cattle on the one hand, and suspected

and beef cattle on the other, and finally were compelled to reduce their indemnity and proceed under the same disadvantages as other States. In New Jersey, after a period of work, the pleuro-pneumonia law was abolished, and the whole matter put under the control of the State board of health with the utterly inadequate appropriation of $5,000 a year. The result has been that infected herds have been left to themselves without even visitation by State officials, until the plague had done its worst.

Governors and legislators seem to forget that the extinction of an animal plague is not a piece of work like the construction of a steam-engine, or a railroad, which can be taken up and laid aside in accordance with whim, caprice, or apparent necessity. The case, gentlemen, you can better appreciate as the counterpart of the neglect of weeds. The single thistle which you allow to grow to maturity scatters its thousands of seeds on the viewless winds, and increases the work proportionately for the future. Careless methods or intermittent work on these animal plagues is but prodigality of the public money and abuse of the public confidence. What is demanded is a well conceived system, rigidly and impartially carried out, until the last infected animal has been killed, and the last germ of infection has been destroyed.

I would therefore propose that a memorial be sent to Congress expressing the sense of this convention, as to the imperative necessity of prompt legislation and executive action on the lung plague, and to the need of a liberal appropriation to be employed for the extermination of this plague only until it shall have been completely annihilated.

Professor LAW. Referring to the efforts made in New York——

The President asked. I should like to ask, if you can tell us, how much it would cost to wipe out pleuro-pneumonia in the State of New York?

Professor LAW. It would be difficult to estimate this without knowing the precise limits of the disease at present, but I think that the money now appropriated in the State of New York—if it had been available with the proper power, at the commencement of 1880 when the work was virtually stopped, that is, if we could have stopped the movement in Brooklyn and suburbs, as we had in New York, I think that money would certainly have been enough.

The PRESIDENT. How much was it?

Professor LAW. Fifty thousand.

The PRESIDENT. Why was it stopped?

Professor LAW. I don't know.

The PRESIDENT. Whose officials were employed?

Professor LAW. State officials. The trouble was this, when the new appropriation was made I began at once to lay measures for increasing our staff to carry the war into Brooklyn and suburbs, the first and last home of the plague in the State, and I was met at once by an order from Albany to cut down the staff.

The PRESIDENT. This law of New York authorizes you to slaughter cattle and pay for them?

Professor LAW. Yes.

The PRESIDENT. To what extent were you obliged to reduce your staff?

Professor LAW. We had to dismiss two or three inspectors; I left at that time, feeling that my reputation was at stake, and that only discredit could come of my continuance.

The PRESIDENT. How many men did you employ?

Professor LAW. We had eight veterinarians regularly, and others were called in when occasion demanded. Beside these, were non-professional men as clerks, yard men, &c.

The PRESIDENT. How many cattle were destroyed and paid for at the time?

Professor LAW. Seven hundred and eighty-three cattle have been killed and paid for, some thousands more have been killed, as suspected, and used for beef.

The PRESIDENT. Was the attempt an expensive one?

Professor LAW. Indemnities amounted to $24,726.27.

The PRESIDENT. Were the funds exhausted when the work ceased?

Professor LAW. No.

The PRESIDENT. Why, then, did the work cease? What was the trouble?

Professor LAW. It didn't cease; only partially so.

The PRESIDENT. By order of the governor?

Professor LAW. Yes. The great desideratum from the beginning was the lack of power to control the movement of cattle in infected districts. I may illustrate by making a statement in this connection. In New York City no bovine animal was allowed to appear on the streets without a signed permit of the proper date, stating where it started from, destination, owner, &c., and giving so many hours for the journey. No animals were allowed to enter the city except in special cases, by permit, or through the bonded yard, into which these animals had to come by boat or rail from uninfected districts. The veterinarian had to be at the yard and examine every animal, and give certificates for each animal. Three months of this active work had nearly cleared the city. In Brooklyn no such control could be exercised, and the disease remained very prevalent.

The PRESIDENT. Where did these cattle come from?

Professor LAW. Western New York and the States of Michigan, Ohio, and Western Pennsylvania.

The PRESIDENT. They were put in these yards and there caught the disease?

Professor LAW. Not at all.

The PRESIDENT. Where did they get it?

Professor LAW. Their opportunities for contracting the disease began in Brooklyn, in the dealers' stables, where sick cows were sometimes temporarily accommodated; next in the infected dairies, to which they were sent; and finally, if they escaped both, on the infected lots on which they pastured in common with other herds.

Mr. SAUNDERS. I understood you to make the assertion, during the course of your remarks, that for $2,000,000 this disease could be exterminated. I would like to know whether you make that statement at random or as the result of actual estimation.

Mr. LAW. Judging from my estimate, and from my knowledge, I think it would probably cover the entire cost and leave a considerable margin.

The PRESIDENT. About how much did you say it would cost?

Mr. LAW. About $2,000,000.

Mr. SAUNDERS. How many millions, Mr. Law, would it take, in your judgment, to exterminate this in twelve months?

Mr. LAW. That is impossible to say. I cannot give an answer to that question. If twelve months hence finds it near the present area, it would probably be covered by the amount I name. If it were carried out West, no estimate can be made of its probable cost.

Mr. SAUNDERS. How many months would it take to exterminate it if carried West?

Mr. LAW. If carried west of the Alleghany Mountains there is no telling to what extent it might reach. The danger of its being carried West is, in my opinion, increasing every day, and the danger is largely increased by sending large numbers of animals to the West. Formerly few cattle were sent West. Within three years there has started up a new trade—a trade which in the last fifteen months, up to the end of August last, had grown to large proportions. I was told that it had reached the enormous number of one and a half millions at Chicago alone. Another great danger is in sending thoroughbred cattle to the West. One danger is the great increase in the country in the number of imported animals, of short horns in particular, which have deteriorated so much that they have come down to a low price; and hence the demand for imported short-horns, to improve the present grade of cattle, is increasing.

Mr. Saunders. About how many calves were raised in Chautauqua County this year?

Mr. Law. About one-half million calves have gone into Chicago in the last six months, and of forty thousand, two-thirds have nominally gone from Chautauqua County. We think they probably came from farther off, though none of the men so reported them.

Mr. Saunders. Is not feeding them on glucose slops one of the main causes that produce this disease?

Mr. Law. No. I could give you some statistics in regard to that, but I have not the figures here with me, and so am compelled to speak in general terms. In the first place, where the cattle suffer so much from disease in the East, very few are fed on this kind of food. In the second place, in the West, where we have many factories, we have no disease, and in the West we find cattle living on similar products, the swill of distilleries, &c. We confine them in close buildings as well adapted to their health as in the East, but there has not been a single instance of this disease originating there. They ship these cattle all over the country, and I should judge the manner in which it is done is unhealthy. I think it is calculated to produce disease. This disease, as I have before said, came originally from a foreign country.

The President. I think an appeal to the States where this disease exists, through the executive authority, would produce a good effect. Professor Law has said that this disease could be removed by extirpation and by the employment of the processes resorted to in Massachusetts to get rid of it. I think that after I state precisely what was done in Massachusetts that any one can see what ought to be done elsewhere. I have no doubt the facts are familiar to most of the members of the convention, but I will briefly refer to it. In 1859 there were imported from Holland to Massachusetts some Dutch cattle, since called Holsteins. They were taken from Boston to their destination on wagons, because they were in such a condition that they could not travel on foot. Three of them died shortly after their arrival. Out of the herd there was a calf sent to the town of North Brookfield, in the county of Worcester, where the dairying business is conducted on a large scale. This animal went there about the month of November, 1859. In the winter it was discovered that the calf, as well as other cattle associated with it, were attacked by a disease which was soon ascertained to be contagious pleuro-pneumonia, the history of which was well known, and the remedy for which, in England, Holland, and South Africa, had been extirpation. Some working oxen engaged in moving a barn caught the disease from those of their number that had been exposed, and soon an area of ten miles square was found to be infected. The legislature was applied to by the agricultural board for some remedy. A commission was immediately appointed, and $125,000 were appropriated to extirpate the disease. As a member of that commission I assisted in isolating every case in the infected district. After isolation if a diseased animal was found, he was killed at once, and the infected herd with him. Not a case has been heard of in the State since. The remedy applied in Massachusetts can be applied everywhere.

Professor **LAW**. I think this disease is flourishing in this country and has for forty years, and so has kept our Eastern States in a constant state of infection, and will continue to do so until we stamp it out. I will allow this much to be true, that in winter it has not that deadly character which it has in other countries where, according to several eminent veterinarians, it destroys entire herds without exception, as in Brooklyn and New York, and therefore I think that if the proper steps are taken to prevent its introduction into this country that it will not propagate itself. It is now thought that the disease is not, in the heat of summer, as fatal as in Europe.

A **MEMBER OF THE CONVENTION**. Would it not flourish as well here as there if not exterminated?

Professor **LAW**. I think there is no remedy equal to extermination. If it go on it will largely concern the cattle traffic. In England it goes to the great ports and from them is spread all over the island. It has had no disposition to spread from where it originated, except in some cases, but wherever carried from infected animals it has spread as fatally as in England. If carried to the sources of this great traffic I do not think that even the high, clear air of the plains would prevent its rapid development, as it has in the steppes of Asia, or in Australia, where the climate is alleged to be one of the finest in the world for bronchial affections.

Mr. **GILLHAM** said he feared we were beginning to think that the disease could not spread. Professor Law had forcibly expressed the truth by saying that the current of trade is against it. He had had experience with the difficulties of the situation, and was glad to hear Mr. Aiken say that the Agricultural Committee of the House were going to investigate that question this session. Some think that the States might do everything, and others think they can do nothing. Now, if the States themselves would take hold and exterminate all the cattle in their respective States infected with this disease, that would simplify matters a great deal. We have seen that New York and Pennsylvania make little effort to check it—that Maryland has done little or nothing in this direction, and right under the shadow of Congress. It is useless to make the effort to prevent its spread, unless we can have some legislation on the part of Congress that will make it an object. The West realizes the very grave character of the danger threatening us. Its spread throughout the West would entail a loss of millions of cattle, and yet we are told that it will only require the expenditure of the pitiful sum of $2,000,000 to stamp it out, if what is called the best government the world ever saw would act promptly and efficiently. Illinois would spend that sum for such a purpose. That State recently passed a very stringent law prohibiting the importation of cattle, and while this checked the importation it cannot affect cattle in transit across the State. These cattle will stop at Galveston, at East Saint Louis, and are there penned. The legislature is powerless. If there is anything to reiterate it is what has been said by the chairman of this convention, for this convention can do something. Get this before Congress—get it before the States—get it before the efficient farmers in all the States, and that will give you a system of some account to stamp one this disease. This department, whatever its sins in the past, could wipe them all out, if Congress were to aid it in the important work of averting this trouble, to which our people are looking forward with fear.

Mr. Gillham closed by advocating the adoption of resolutions by the convention expressing the sentiments relative to the extermination of this disease.

Dr. **Loring** explained a bill introduced during the last session of Congress, and said: The bill of course met with a good deal of opposition. There were certain constitutional questions raised with regard to the rights of the Federal Government in the States, and of Congress to appropriate money for such purposes. Meanwhile Congress adjourned and the matter was postponed. That bill is still in existence, and contains measures for the extirpation of this disease which would not only be effective, but the most thorough, accurate, and scientific. I think that these bills might be collected by a committee of three of this body, in order that we may understand what is now before Congress. Colonel Aiken will be happy, I doubt not, to assist. A strong statement of the whole matter could then be prepared setting forth to Senators and Representatives the need of this great and growing interest; and I move, therefore, that a committee of three be appointed for the purpose of securing all the bills that are now before the House, or that were before Congress at the last session.

Mr. **Saunders**, of Illinois, heartily concurred in the motion made by Commissioner Loring, and gave an account of an interview with ex-Senator Kirkwood on yesterday with reference to this bill, and the reasons why it did not pass at the last session.

Mr. **Aiken** and Commissioner Loring further explained reasons for non-action on the part of Congress.

Mr. **Saunders** stated that any proper bill brought forward this session would have the support of the Speaker of the House.

The **President** *pro tem.* (Mr. **Blount**). How shall the committee be appointed?

Commissioner **Loring**. I move that it be appointed by the chair.

A **Member**. I move that the committee consist of the Commissioner of Agriculture and Messrs. Gillham and Aiken.

Dr. **Loring**. I wish to be excused. I will co-operate with the committee with great pleasure, but I think the committee should be composed of the delegates.

The following committee was then appointed: Messrs. Gillham, Meredith, and Law.

Colonel **Aiken** referred to the remarkable fatality of cows taken from the North, and asked Professor Law why it was that if a grown bull or cow is taken where there is limestone water that certain death follows? There is no such effect produced on other stock. He had brought horses from Central New York and has had no trouble. We only have to preserve them through hot summers. I have brought sheep from Southern Ohio, and they have been very carefully raised, yet they lost all their wool.

A **Member of the Convention**. Were they Cotswolds?

Mr. **Aiken**. No, sir; they take no Cotswolds to my State; they are thought to be too large.

A **Member**. Have you taken any from Tennessee to South Carolina?

Mr. **Aiken**. The finest I ever had were from Lexington. But referring to this fatality, I have known a magnificent cow bought in New York to die in three months after reaching Charleston.

Mr. JACKSON. What condition are they generally in?

Mr. AIKEN. In good condition—in the best possible condition. It is a question of great importance to us. We are all meeting with the same ill success. If I could get a satisfactory answer to the question I have asked I should take the privilege of publishing it. We believe that the Jersey cattle will find a better home in South Carolina and Georgia than anywhere else. They will fatten better and do better, I think, than they would in New England. We are very much interested in them, and all the people in my country are desirous of getting them.

A MEMBER. Is it near the coast where the gentleman lives?

Mr. AIKEN. I am not on the coast. My place has a fine location for cattle.

A MEMBER. How far does this condition of affairs extend beyond Carolina?

Mr. AIKEN. I have heard of the same thing in Georgia.

Mr. LAW. Does this locality not extend beyond South Carolina, toward the coast?

Mr. AIKEN. Yes, sir.

Mr. LAW. Must the calves be fed on milk?

Mr. AIKEN. No, sir; I have never fed them on milk. I have fed one on green food and a little meal.

Mr. LAW. Are there any trees in the pasture?

Mr. AIKEN. There are no trees.

Mr. LAW. What is the nature of the disease, if it can be made out?

Mr. AIKEN. That is a question I cannot answer. I remember distinctly that the cause of death of two fine heifers was, in my opinion, bloody murrain, but what caused the death of my Seneca Falls bull I did not know. He did not come up in the afternoon, and I found him lying on the ground as if asleep; he had something like *meningitis*. He died during the night, and one of the two that died later died in the same way.

Mr. LAW. Did you notice the carcass. Had it a yellowish hue?

Mr. AIKEN. The only thing I found in the way of discoloration was in the intestines, and these seemed to be congested.

Mr. LAW. And the coat of the stomach?

Mr. AIKEN. It was a good deal congested.

Mr. LAW. It is an understood and well established fact, that the Texas fever extends to North Carolina, and I would presume that this is the same thing that you describe.

Mr. AIKEN. Where would the Texas fever originate if I bought them in New York or Tennessee?

Mr. LAW. It has been planted there and extended from your native stock, though your native stock have now acquired immunity from it. Not only is this a general principle, but it is the case, with reference to certain diseases, and particularly anthrax, which is contracted in pregnancy. The germ of the disease has never yet been found in the uterus, but the chemical products have been.

The PRESIDENT. Let me say with regard to the Jerseys of the South, that I have found to my surprise that the Southern States seem to be the home of this breed of cattle. There have been a great many imported into Massachusetts, but in South Carolina last autumn I found them in fine condition, with heavy and strong muscles, well developed, and in a thrifty condition in every way. There is something in the climate of that section which is promotive of the health of a delicate and sensitive animal like the Jersey; on the other hand the short-horn does not thrive well there, his physical organization being made up for the production of fat entirely, and not being suited to the oppressive heat of the Southern States. The delicate and smaller animals, however, find the South their natural home.

The difference between the physical organization of cattle for the dairy and for the production of beef is very great, and I hope to lay this matter before the convention more fully when the question of the dairy comes up, for I think I can account in a measure for the difficulty that exists in raising heavy beef cattle at the South. There is no reason why it should be considered a misfortune. I am perfectly sure that the South has an opportunity for animal growing exactly as good as any other section of the country, care being taken to select the proper breed.

The time has arrived for adjournment. I intended to have an essay read by Mr. Hazard, on Jersey cattle, and this will be first in order in the morning.

Mr. SAUNDERS. I move we now adjourn.

The motion was agreed to, and at 5 p. m., the convention adjourned.

FRIDAY MORNING, *January* 13, 1882.

The convention was called to order at 10.30.

The president announced the first business to be the reading of an essay by Mr. Hazard, of Pennsylvania, which was presented, as follows:

THE CHANNEL ISLANDS—THE PEOPLE AND THEIR CATTLE.

By WILLIS P. HAZARD, WEST CHESTER, PA.

Directly south of England flows the British Channel, connecting the North Sea with the North Atlantic Ocean, and separating England from France. After passing through the narrow straits between Dover and Calais, the English Channel widens very much, owing partly to bays and harbors on the English coast, and partly to two large indentations or bays on the north coast of France. In the easternmost bay lies Havre; on the point of land separating them is Cherbourg, the naval depot of France, and in the western bay lies a group of islands and rocks quite adjacent to the coast of France, and so completely land-locked and within the shelter of that country, that the map-student is amazed when he is told that these islands belong to England and not to France; still more so when he visits these islands and finds nearly every hamlet and parish bearing French names, the customs and habits French, and most of the transactions carried on, and the papers published in the French language.

From their situation, these islands are called the Channel Islands, though more popularly known by the individual names of the larger three of the group, viz., Jersey, Guernsey, and Alderney. These have attracted the attention of England and America in recent years, through the merits and beauties of their two famous breeds of cattle, the Jersey and Guernsey breeds. And these have, until within a short period, been generally known under the generic but erroneous name of Alderney cattle.

But independent of these more modern claims to notice, the islands have a story and song of their own, their history reaching so remotely into the past as to be lost in the dim obscurity. They were famous in Roman narratives of wars and conquests, were prominent in the histories of William the Conqueror, of King Charles, and of Queen Elizabeth. Their ecclesiastical history embraces the rites of the Druids; their temples trace back almost to apostolic times, and the Romanists and Protestant faith have each at times held entire sway, and been the cause of intestine as well as of outside wars and attacks. The people often called to repel, have left the evidence in their many towers, castles, and forts still standing. And to this day we find in their independent spirit, and their laws, the evidences of their freedom and their courage.

The Channel Islands are by many supposed to have at one time formed part of France; and, indeed, tradition asserts that at certain times of low tides, the passage from one shore to the other was made on foot over the rocky connection. The peculiar character of the many rocks surrounding the islands, at times jetting from the sea, and at others hid just beneath the surface, all indicate the wearing and disintegrating power of the sea and its conflicting currents, as they wash violently in the changing channels. These are what make the passage between the main land and the islands so dangerous, especially during storms and fogs. The passenger never considers he is safe until his foot is on dry land. Though the length of time of the trip from Southampton is usually about eight hours, it is frequently two or three times as long. Where the tides rise and fall often from thirty to forty feet, and the steamers sail at one particular hour, without regard to the state of the tide, and the narrow channels between submerged sharp-pointed rocks are thus made still narrower, it is not to be wondered that shipwrecks occur. One took place in the main harbor of Jersey, on a Sunday morning in February, while we were there, and within three hundred feet of the steamer's anchorage.

The larger islands lie nearly south of each other, and of England, and in the following order: Alderney and the Casquets, about 60 miles from England; Guernsey, Herm, and Serk, 70 miles; and Jersey 90 miles. Alderney is 3½ miles long, by 1 mile broad, having 1,962 acres; Guernsey is 9 miles long, by 7 miles broad, having a population of 30,000; and Jersey is nearly double the size of Guernsey, being 11 miles long, by 5½ miles broad, having 40,000 acres, and 57,000 population. The smaller islands of Serk, Jethro, and Herm, are sparsely settled, but very picturesque and beautiful to the lover of natural scenery and history.

THE SCENERY.

All of them have rocky coasts of the wildest grandeur, difficult of access, and only equaled by those of Cornwall, parts of Ireland, and of Scotland. Forbidding as is the approach, the interiors of these islands have some of the loveliest rural scenery, reminding the tourist of the softened landscapes of Devonshire. The climate is so mild and the atmosphere is so moist that nature rounds all the outlines with a profusion of verdure nearly always fresh and green. While the majority of the roads are level, still there is enough hill and dale, intersected by streamlets, to ever present varying undulations and views in the landscape. Consequently the lovely scenery, the mildness of the climate, and the novelty of the surroundings, together with the ever-changing sea-views, attract tourists, invalids, artists, and naturalists, at all seasons of the year; though the larger number visit the islands in the summer or holiday season; at this time the daily boat frequently carries over four hundred passengers. Were it not for great danger at all times in following the narrow channels through the great masses of rock, and contending with the strong tides and conflicting currents which sweep with great force through the great bay on the French coast, in which these islands are situated, visitors would be numbered by many more thousands. The steamers are frequently obliged to lie by during fogs, and at all times to move with great caution. But when the winds are quiet and the atmosphere is clear, the voyage is one of great pleasure.

THE JOURNEY.

I wish I had power over your imagination, and then you would realize that we were taking one of the cars of the Southwestern at Waterloo station in London, in the afternoon, so that we may have time to look around Southampton, the great shipping port. As we arrive alongside the dock, our luggage is transferred to the steamer. We have secured a good berth, and we stroll up into the city to pass away the hours until midnight, when the steamer will leave. Having stopped at the hotel and eaten a good chop, washed down with a glass of ale, albeit it was spiced with a good deal of snobbery from the waiter, we feel better fortified to brave the terrors of the channel voyage.

Again on board of the steamer, we patiently watch the play of the harbor lights upon the plashing water, as they rival the sheen of a nearly full moon. Having also filled in the time by asking the officers and men of the steamer what was the prospect of a smooth sea, and being reassured by them, we gladly hear the whistle of the last train approaching; the passengers are soon transferred to the steamer; the bustle incident to the starting is at last over; every passenger is finally accommodated with a berth; the steamer is cast loose, and is soon under way. With a lingering look at the surroundings, and the harbor's lights as they dim in the distance, we trust to the bright moonlight and the favorable wind for a fair passage, and seek our berth, hoping to get to sleep while the steamer passes down the Solent, past the Isle of Wight, and before leaving the three light-house rocks, called The Needles, at the point of the Isle of Wight, and enters upon the conflicting currents of the channel. Vain hope! for the snoring of your neighbor, who can sleep anywhere, the incoming of those who have staid on deck to see the scenery by moonlight, and above all the stowing away of the cable chains by the donkey engine and steam windlass, in a compartment built in the center of the berth cabin to hold it, all these drive away sleep, until you have passed the Needles, and meet the long swell or the chopping sea. Then for the hours of nearly mortal agony! And you lay wondering why you should have to start out on such a voyage at midnight.

The day at last breaks, and after a time you summon courage to go upon deck, and find you are passing through the Swinge, or pass between the Casquets, on the right, and Alderney, on the left. As the steamer does not stop at Alderney, you gaze at it as it rises with its blue outline against the horizon, and turn to the Casquets, to see these rocks rising abruptly above the water, and surmounted by three lights one hundred and twelve feet from the surface, directly in the track of vessels. The lights can be seen in clear weather for 20 miles; but in foggy weather a bell is sounded. These Casquets are only the terminal rocks of many others connected with Alderney, with a narrow, dangerous, rocky passage between them.

GUERNSEY.

On we go through the bay of St. Michael, finding the currents combatting with the tidal wave, for here they set from every point of the compass, owing to the vast numbers of concealed rocks, but as it is not foggy we know we have not that great danger impending over us. Guernsey, ten miles from Alderney, is shortly seen looming up; at first like an indistinct fog, then as a leaden-colored line upon the sea, gradually becoming more distinct and defined, until we descry a bold, rocky coast, rising in bluffs from the sea, but indented here and there with bright green sward leading down to the sandy beach, whitened by the glare of the sun.

Doyle's monument towers on one of the bluffs, and shortly Castle Cornet comes in sight, on a high hill overlooking the town and harbor, and we notice the signals being run up to announce our approach. The arrivals and departures of the steamers are the events of the day, and the sleepy town is soon enlivened, for here comes the connecting link with the rest of the world, and the mails and papers are eagerly looked for.

On the left lie Herm and Jethro, and further in the distance Serk; we glance at them as we pass by, and round into the stony harbor, shooting through the narrow entrance, and soon ride safely at anchor in smooth water, under the shelter and protection of Castle Cornet, itself originally constructed by the Romans, and having many historical associations.

ST. PETER'S PORT.

Let us look behind these and we shall see the stony, rusty-looking old town, rising in terraces upon the hill upon which it is built, fronted upon the shore by a wide esplanade, and backed by the green of the suburbs, prominent among them being the house of the governor and Carey Castle.

A stroll through the town of St. Peter's Port will reveal some of the quaintest old structures, hundreds of years old; the narrow, winding, hilly streets often without sidewalks, but stony roughness in the middle of the streets; these lined with curious small shops, or thronged with a bustling population, partly in quaint costume. We look into the old church, now nearly six centuries built; and as a contrast, visit the handsome new market-house and hall. Here we have a look at the rural population and products. In the middle of one part of the house are benches, placed back to back, upon which sit a number of women chatting with each other, each holding upon her lap her market basket, with its contents covered with linen or other covering. How gallant and kind it seems to have provided for the female purchasers a place for rest, and to have a social chat. But directly we are undeceived, for when we pass near several of the baskets are uncovered, and the contents are attractively displayed to tempt a purchase. How nicely the golden circles of butter look; how white and fresh the eggs! Ah, then, here the women sell the butter of their own make, and well they understand the art; that's why the circles are nearly double the size of our pound lumps, though they are only half as thick. Well stamped, and of the deep rich color which only Guernsey cows can yield, taste after taste will assure you there is none better. As the herds are not large in Guernsey, each maker can easily bring in her basket the few pounds she has to market, and the few eggs she gathers, for poultry is not plenty in Guernsey, for it is not a grain growing country, and Normandy and Brittainy, in France, supply most of the poultry and eggs used. We saw, at one time, forty tons of eggs upon the wharf in Jersey, landed from a French steamer, and *en route* for the great markets of London. They were packed in neat flat boxes, holding one hundred pounds each, and were there piled up in many a row.

Further rambles through the market revealed many curious edible things, particularly among the crustaceans. There were shrimps, muscles, snails, the haliotis or sea ear, escallops, oysters, and other to us unknown bivalve and univalve edibles, as well as crabs and lobsters of large size, and crawfish. The variety of fish of course is very great; there are the delightful whiting and turbot, rockfish, mullet, cod, mackerel, and tunny; also the *roselet* smelt, and *lançon* sand-eel are said to be delicate little morsels. But, strange to say, many of the fish are brought from London to this market, as the fishermen seem to decline to break bulk. Fish shipped early in the morning on the steamers is eaten by the Londoners the next morning.

The meats we examined with care, and tasted with relish the Guernsey beef, as we felt anxious to test its quality, to know whether the animal of that breed made good beef. We found it to be juicy, tender, and delicious, with a fine peculiar aromatic flavor. The color of the fat is of a deep orange color, much darker than that of the short-horn or Devon, and to many would be somewhat objectional, but only from prejudice. It is even of a deeper yellow than the fat of the Jersey. The meat at the same time is of a deeper red than that of other animals. Most of the beef used in Guernsey and Jersey is imported from France, and is landed under special restrictions. The animals are driven under an inspector's eye to the public yard, marked, and only allowed to come out to be killed at once by the butcher. The islanders guard their two noted breeds very carefully from any chance of being crossed, and do not allow the cattle even of one island to be imported into the other. This is one of the values of those animals imported into this country—the assurance of the purity of the breed.

Of vegetables, the variety is not very large. In winter mainly potatoes and cabbage; of the latter, a variety is kept up by broccoli, cauliflower, and brussels-sprouts. In spring and summer, asparagus, peas, beans, beets, salads, carrots, radishes, turnips, &c. Celery is plentiful and good; tomatoes are scarce, and unappreciated. Parsnips are raised in large quantities, and are, with ruta-bagas, one of the chief reliances for winter feed for cattle. It is to the parsnip it is said the fine flavor of their beef and pork is to be attributed.

Let us keep on ascending the steep and winding streets, and now turn off to take these steps or stairs as more convenient, which bring us to the upper street more quickly. As we stop to take breath, look around each time, and what a panorama you behold! Far below you is every variety of rocky coast, indented by pretty coves, with sandy beach, upon which the sea rolls up, dashing itself into spray, which sparkles in the sunlight like so many diamonds. There lay Jethro, Herm, and Serk; and, as it is a very bright day, we see the blue outline of Alderney in the distance. Directly below us lies the town, with its several church spires, its Victoria and Albert monuments and Elizabeth College, all standing out in bold conspicuity. A moving column of smoke attracts the eye to the esplanade of the town, skirting the coast, and we see the dummy engine of the tramway drag its retinue of cars to St. Sampson's, the other port of the island. If we take the cars to St. Sampson's we shall witness the little fleet of ships loading with the Guernsey granite cubes, which are to pave the streets of London.

VICTOR HUGO'S HOUSE.

As we descend from the hill let us stop midway and inspect D'Hauteville house, the residence of Victor Hugo, for perhaps nowhere else can we see such a collection of curious old oak carvings, tapestries, rugs, chests, altar pieces, chairs, candelabra, and all that rubbish which is denominated bric-a-brac. The walls, the ceilings, the floors, the beds, everywhere it can be stowed, are covered and hidden under this mass of carved wood and tapestries. Throw open the window-shutters as you may, you cannot illumine the somber effect produced by these quaint old bits of carving, these faded old tapestries. If ever there was a home for ghosts it is here, and momently one expects to see the hangings move, to see some helmeted creature lead forth some stately dame, clothed in quaint haberdashery. Ah, what a night of horrors might be conjured up there after a heavy supper. There stands the bed as prepared for Garibaldi, with its moth eaten covering, its faded hangings; but he never had the courage to try to sleep a night in it. This wealth of antique furniture properly bestowed in a number of houses, would be charming; but crowded into this one house overdoes the matter. Victor Hugo was an enthusiastic collector, and gathered this material from every quarter in the island, and the tapestries from abroad. Now it has become so very scarce we, with difficulty, could pick up a few bits of carving and majolica. The article we should most prize was the camp chest of Napoleon, studded with brass nails, so constructed as to form a chair, a table, and to hold his maps, dishes, &c. Victor Hugo's "Toilers of the Sea" should be read by every one interested to know more of Guernsey life. In Hauteville house Hugo spent many years of his exile, and his figure became well known in the town; now he visits it only in the summer. From his balcony is presented one of the most ravishing views of the sea and of the rocks.

THE RURAL PORTION.

Let us spend our second day in a visit to the rural portions of the island. As we drive up the steep hill to leave the town we pass through the newer portions, mostly of houses built in the English style and by the English, who are yearly supplanting the old Norman French inhabitants and their descendants. The houses are of dressed stone in the English villa style, with ornamented front gardens, and grounds around them; neat with paint and plate glass, and each with the name of the villa painted upon it. Here you will see the wealth of horticulture which adorns the Channel Islands. We saw camelia trees over twelve inches in diameter and thirty feet from one edge of the shadow to the other, covered with many thousand buds and flowers, of the purest white or delicate shades of pink and crimson. They are almost constantly in bloom. Fuchsias here grow as high as the cornice of the house, like trees. Geraniums are standard, and bloom all winter. The arbutus ripens its winter strawberry. The magnolia is a noble tree. The noted Guernsey lily, though originally from Japan, flowers freely everywhere, as well as all the Cape bulbs. The gladiolus, ixia, and belladonna are to be seen in profuse blooming. We saw almost every species of tropical plants growing in the nursery grounds in the open air, and rhododendrons in the richest bloom and variety of color.

As we drive along the excellent roads and past the adorned grounds of the houses, we cannot fail to be gratified with the exquisite floral display and the abundant perfume. The roads are bordered on each side either by hedges of holly or by banks of earth upon which grow the gorse or furze, the butcher's broom, the bramble, and other wild plants, and the whole is softened by the ivy clinging, twining, and covering everything with its dark rich green foliage. While overhead we have shelter from the ilex or evergreen oak which is the most common tree, and always retaining its bright green foliage, varied by the elm and the beech. Trees are not much fancied by the farmers as they harbor birds, but they are allowed to grow in the hedge banks along the roads for the fuel they furnish, and consequently they are kept so trimmed as to spoil their beauty. Few things are more unsightly than these tall tree trunks in winter, with diminutive switches or branches growing from every side of them. These are constantly pollared and made into faggots for the open fire places or ovens which are found in all country houses. They use also for fuel the gorse dried, some of the seaweeds, and most curious of all dried ordure of the cow. Great piles of all these can be seen stored away under the farm sheds.

In summer these shady roads and lanes winding through the country are frequently very beautiful, the branches meeting in graceful arch overhead, and presenting a continuous perspective, realizing the Gothic arch which is said to have had its origin from this natural arch.

The roads are built on the Telford plan, and are of the most admirable kind. First is laid a bed of large stones, upon which are placed medium sizes, and upon that small stones are broken up. They are kept always in perfect repair, and at stated times raked and swept. Along both sides of leading roads are side paths about four to six feet wide, raised six inches from the roadway, and separated from it by a line of stones set edgewise. The wheels of all vehicles are made much heavier than ours, and with tires of much broader tread; in fact, such vehicles as our trotting wagons or carriages would not be allowed, as they would soon cut the road into ruts, which are never seen on these islands. Yet, strange there is much less driving than with us, and much less pleasure driving, partly owing to the econominal habits of the people, partly to the good sidewalks and the bracing nature of the atmosphere inviting to walk, and partly to the little value placed upon time.

GUERNSEY AND JERSEY FARMS.

The farm-houses, formerly small stone cottages, one story and a half high, are now of much better character. In Guernsey, many more of the old houses remain, but in Jersey these are either being torn down and the material used again in new and more commodious structures, or they are converted into stables. In Jersey, in a few years, it will be difficult to find true specimens of the old thatched stone cottage, so fast are the inhabitants getting rich from the London market prices for early potatoes, fruits, and vegetables, and from the sale of live stock at high prices. In Guernsey, the people, too, are more conservative, and pursue the old methods of their ancestors more closely than in Jersey. The cottage may be more picturesque, but the mansion is more comfortable, and it was partly for this we admired the Guernsey landscape more than that of Jersey; it had more of the quiet softened beauty of luxuriant nature, while that of Jersey had an air of new smartness which did not soften the landscape; only in Jersey we found more of the beautiful shady lanes.

Surrounding the farm-houses are the stables, wagon houses, piggeries, &c., mostly in great numbers, of one story or one and a half stories high. Barns are not seen or needed; the hay and grain are stacked out, and frequently great heaps of roots are dumped on the ground and covered with some straw or earth, and fed from one end of the heap as wanted. All these buildings and surroundings are kept in bad order, and the cattle are shut in dark, foul, reeking stables, with little light and no ventilation, as much for the sake of warmth as from carelessness. Were it not that the cattle are let out every day for a short bite at the grass in winter time sickness would be very prevalent among them. In Jersey the stables are now generally much better, and, in many cases, two stories high, though they are kept but little cleaner. In each island stone walls are plenty about the farm-yards and entrances, and are really necessary for protection against the severe and cutting winds which at times prevail in winter and spring. The past winter was the most severe for forty years, and I saw snow from four to six inches deep, which laid for more than a week. It was comical to see some of the sleighs improvised for the occasion by some of "the bloods," and the contrast of the fine horses and harness to the rough sleigh. I saw hedges, trees, and plants all blackened by the cutting wind as much so as if scorched by fire, and their development greatly retarded.

THE JERSEY CATTLE.

The cattle of these islands are now famous for their beauty and their merit, and are of late being widely scattered over our whole country. In the comparatively short time that they have assumed prominence there must be some great value in the breed to so assert itself. We shall, therefore, make it our object to trace the history of these breeds, and to point out why they are so sought.

The origin of the Jersey breed has been by most writers traced back to the neighboring coast of France, and more particularly to that part of it called Brittany. To this day cattle very similar in size and appearance, and which might be sold as inferior Jerseys, and have been largely so sold in England, are to be seen there. Professor Gamgee wrote a special treatise on Brittany cattle, advocating their merits. But the Brittany cows are not so well developed in their udders, have not as deep barrels, or, as we say, have more daylight under them, nor are their horns as fine or crumpled as the Jerseys. But this inferiority is much owing to the ignorant management by the Brittany peasants and their careless breeding.

The curious fact, too, in support of this origin, is that wherever Druidical remains have been found there also has been prevalent a small breed of good cattle, and mostly of black and white, or of a cream or dun color. The original colors of the Jersey breed, as stated by writers of the time, were of black and mulberry, and of a cream color, and in most of them plashed with white. To this day a black Jersey, with the peculiar mulberry brown stripe running along the chine and spreading into the black on the sides, particularly if it has the golden lustrous tinge which fine hair and oleaginous skin give it, is one of the best colors, if there is anything in color, as we year by year grow to think there is, that you can have on a Jersey.

Whatever the origin of this breed, we know the fact that for two centuries it has been famous in the island as a good one, and that great care has been taken to perfect it and to keep the breed pure. Necessarily in so small an island, and where the number of animals were so few, the effect of breeding without introducing new blood would be, to a certain extent, in-and-in breeding, consequently certain traits would be perfected, increased and maintained; while at the same time, owing to the manner in which this was carried out, the size and stamina of the animals might be lessened.

That this is the case, those who have paid attention to the breed for a length of time are perfectly well aware. Such remember the size and color of what is now called the old-fashioned Jerseys. They were of a much larger size than at present, and would weigh from ten to twelve hundred pounds, and were usually of a dun color. Then came the fashion of having them smaller and finer, and of a cream color, and mostly blotched with white. The next color sought for was for a deer or fawn color, and all the better if it was shaded in the flanks and about the head with black. As some would retrovert and go back to the old colors, and come solid without any white, and of course were fewer than the others, they were sought for their rarity, and solid colors became fashionable. In breeding for these colors, some would come solid colors, tipped with black, and thus the next fashion was to have solid colors with "black points;" and black tongues and black switches became the fashion. The next color sought for was the squirrel greys, and now to-day it is the blue and silver greys. And so it will continue to be as long as there are charlatans in the trade, who generally are the loudest voiced, and talk up those wares that they have to sell, and as long as buyers will control their good sense and pay the prices asked by fancy breeders. To-day a returning sense to reason is being shown, and it is demanded that performance at the pail shall be the true test. This *is* the true one, only the breeders, not to be outdone, cry out "blood will tell," and demand their fabulous prices for the "forty-eleventh" cousin of an animal that has made its sixteen pounds of butter.

More than a hundred years ago the states of Jersey, in 1763, and again in 1789, passed stringent laws to prevent the importation from France; and more recently they passed a law to prevent importation from Guernsey, England, or elsewhere, thus using every effort to maintain the purity of the breed. The Royal Jersey Agricultural and Horticultural Society was formed in 1833, and they have jealously helped to maintain this purity, and have been mainly instrumental in leading to its development and improvement. They adopted a scale of points in 1834, which has since been altered, which gave breeders an intelligent guide toward creating perfection. In 1838 it was first required the pedigree on both sides should be stated, and this led to the formation of the Herd-Book.

In 1844, "the Channel Islands or Crumple-Horned cattle" first received prizes in England from the Royal Agricultural Society of England, and the prize-takers were sold for about thirty pounds each. From this time forward the breed came rapidly in favor in England until now it is the fashionable breed with the nobility and gentry, more than two thousand being imported into that country each year, while up to this year only one-tenth of that number are imported here.

In 1853 the effect of American wealth and influence began to be felt, for then there were several animals sent to this country, which was much increased in the following two years; prize-takers being mainly bought for the United States. The earliest recorded importation was of one cow in 1815. The number of persons interested in Jerseys had so increased by 1869 that the American Jersey Cattle Club was then started, and the first volume of the Herd Register was published in 1871, with a record of five hundred and thirty-nine bulls and one thousand four hundred and twenty-seven cows registered, and it has now increased to nine volumes.

The two leading sources of income and profit with the Jersey farmer are his cattle and his potatoes. For the development of these, his farming is mainly directed; and from the small sizes of the farms, his farming is more of the nature of gardening. Pasture, hay, and the cultivation of roots and potatoes, occupy the bulk of his attention.

The grass is strong and rich, much like our green grass or blue grass, and clover and lucerne is much used. The cows are led out in summer in the morning, and tethered with a rope or chain to an iron peg driven into the ground by a wooden mallet, and are allowed a space of about thirty feet in diameter. They are changed again at noon. In summer they are milked three times a day—such cows as are flush in milk—from April to August, and during the other months twice a day. When milked three times, the butter is not greater in proportion. As this work is always done by women who lead them to pasture and to water, the animals become very docile.

It is thought an extraordinarily good cow that gives twenty quarts—the quantity being more usually from ten to fourteen quarts—the medium quantity is possibly ten quarts. In summer it requires nine quarts for one pound of butter, and in winter rather less, if they are fed upon parsnips.

The milking is done by the women into a pôt, over which a linen cloth is spread, and upon which is placed an escallop shell. The milking is done upon this shell so as not to be forced through the strainer, and to prevent the rapid wearing of the cloth. From the shell it overflows, and thus is strained as it passes through the cloth. The milk is placed in Norman coarse unglazed earthenware "crocs," or tin pôts, and stands about ten inches deep, until all the cream is risen, which is hastened, in winter, by placing it upon the warm hearth at bed-time. When the milk is coagulated, the cream is loosened around the sides by the finger, the crock is dexterously tilted, and the cream slipped off. If any is left, it is skimmed with an escallop shell. In Guernsey they frequently churn the whole milk after standing for days. Some crocs have a hole with a peg in at the bottom, by which the serous milk is drawn off. They endeavor to churn twice a week in summer. Clover and lucerne are considered to whiten the butter in summer, and potatoes and turnips in winter. The natural pasture, or parsnips, make the richest butter. Late in the fall and in winter the cattle are turned out for a few hours each sunny day, for here the grass is always green, though not possessing strength in winter. The grass in February was as it would be with us about the 10th of May.

The pasture is considered sufficient in summer, and in winter the main feed is hay and straw, parsnips, ruta-bagas, and potatoes. The milk is sold in the towns at three pence, or six cents, per quart, and sometimes in winter at seven cents. Butter is good, but generally not of first-rate flavor, and sells in winter for about two shillings, or fifty cents, and not much less in summer, for the demand is much greater. Not near enough is made for the consumption, and large quantities are imported from France. It is usually self-colored, not much coloring matter being used, though one will frequently hear the term "a white-butter cow."

The butter is churned in a peculiar shaped old dash churn, though the barrel churn, with fixed dashers, is being much introduced. As no farmer makes much butter, it is all done by hand. It is made into round stamped pats, about twice the size of ours, of 18 ounces to the pound, and is sold in the market in St. Helier's, by the wome from their baskets. We saw no spring-houses, and the milk is usually kept in an apartment partitioned off from an outer sort of kitchen or store-house, where, in the main part, frequently roots were stored, and not with that care necessary to make the sweetest tasted butter. Cheese is now seldom or never made.

SIZE OF FARMS, AND PLOWING.

Each cow is calculated to use two and a half to three vergées of pasture, according to quality. The vergée, which is their usual computation of ground, consists of forty perches of twenty-two square feet each, and about two and one-fourth vergées equal one acre. One hundred and four pounds of Jersey are equal to 112 pounds avoirdupois. One hundred and ten gallons Jersey equal one hundred gallons English.

The farms contain, perhaps, on an average, twenty to twenty-five vergées; a good size farm containing fifty to seventy-five vergées. Land is broken up by a large heavy plow, the beam resting upon two wheels, which is drawn by four, six, or eight horses. In February occurs La Grande Fouerie, or great digging day, when the neighbors assemble to assist in breaking up the ground, for much spading is required to accomplish the depth of 12 or 14 inches. First precedes the two-horse plow, which opens a double furrow, which is widened and deepened with spades to a trench 2 feet wide and of the right depth. Then the small plow starts again, throwing the next furrow into this trench, and it is followed by the large trenching plow deepening the furrow, the first few feet having been deepened by spading, to allow the trench plow to take fair hold. The plows are followed by one or two spaders, who break heavy clods or fill up hollows. As each furrow is plowed it is completed and squared by hand. This subsoiling and trenching makes a fine mellow soil for parsnips and potatoes. A good dinner or supper washed down with cider, or something stronger, makes "digging day" a jolly as well as laborious one.

When the ground is prepared, as early in March as possible, or in warm sheltered spots even before that time, every farmer is busy setting out his potatoes, which he has been sprouting with much care in his kitchen or stables. In the stable small, square shallow trays are placed upon racks above the cattle's heads, so that the warmth arising from below will affect the potatoes. The tubers stand on end, placed close together in the tray. The kidney potatoes are those most used. It is of the greatest importance to have potatoes ready for market at the earliest moment; for the price is affected very rapidly in the London market. Potatoes which bring six pence per pound the first week may not bring three pence the next. In the height of the potato season, many extra steamers are put on specially to carry this freight, and great competition exists among the commission men in the large cities and towns in England for the consignments. Many thousands of bushels are rushed into market in May. From these islands the earliest go to London, though Spain is now entering largely in the business.

Green stuff is next marketed, consisting of radishes, early onions, asparagus, salads, early cabbage, broccoli, and cauliflower, &c., &c.

FRUIT.

Fruit claims much attention; about twenty tons of grapes are shipped yearly to London. These are grown under glass, and the long ranges of glass-houses are a striking feature. In these also are grown some of the finest peaches, early strawberries, green figs—which will also grow in the open air on trees trained upon arbors—and dwarf pears. The Chaumontelle pear grows to a very large size, and is very rich and juicy, and a good keeper; they have them all through the winter, and we have eaten them in May. Apples are largely grown, and one hundred and sixty thousand bushels are exported, in good years. They are not good eating apples to an American, used to much finer flavored kinds. Vast quantities of cider are made from them; it is the popular rustic drink, and formerly it was an important item of export, but now the orchards are becoming neglected.

One of the vegetable curiosities is the cow-cabbage, which is a leafy stalk, growing often 8 or 10 feet high, and of which walking-sticks are made; the leaves are fed, and also used for marketing butter.

FERTILIZERS.

The farmers enrich their lands with, in addition to the barn-yard manure, several kinds of commercial manures; but their principal reliance is upon *vraic* or seaweed, gathered from the coast and from the adjacent islands and rocks. There are two vraic harvests, one in February and March, lasting five weeks, and again from June till August, lasting about ten weeks. The dates are announced by the legal officer, when every one may commence to cut, so as to give all an equal chance, and at the proper time not to eradicate the weeds. These are of two kinds; the Fucus, or bladder-wrack, containing much organic matter, and therefore more valuable, and the Laminaria, giving the most valuable ash. The former, when drawn from the sea and deposited in heaps or spread upon the fields, will partially melt away, and is absorbed by the ground. The seaweed is sometimes used, when dried, for fuel.

LABOR.

Labor, formerly very cheap and plenty, is every year growing scarcer. Toward the close of winter laborers come over in the French steamers from Normandy and Brittany, both male and female, dressed in their peculiar costumes. The latter wear no bonnets, but a linen sort of cap, a triangular handkerchief around the neck, short, linsey-woolsey skirts, coarse stockings, and sabots. They are not attractive in appearance, but very sturdy, and walk with a strong stride. They take care of the cows, do the house-chores, and work in the fields, planting and marketing potatoes, &c. Hands will be hired for the season, and both sexes sleep in the barn, and Sunday is spent in baking for the week, washing, &c. They provide their own food, which consists mainly of bread and cider. Thus, though they get little, they spend little, and return to their homes with the proceeds to spend the winter. The wages are 15 pence a day, when employed by the month, and on Sundays they do odd necessary chores for their board. If employed by the year, they get 15 pence the year round, per day. A man can terminate his engagement by giving four weeks' notice, and the employer can do the same, which they often do in the potato-picking season, as they can get 25 shillings per vergée. Most of the employés on the farms are French, and they work very hard.

SALES OF CATTLE.

From the small size of the farms, it may easily be supposed there are no large herds in Jersey or Guernsey. Ten or twelve is an unusual number; five or six are more frequent, and most every farmer tries to have one or two heifers to sell. Altogether, there are nearly twelve thousand head in Jersey, and between five and six thousand in Guernsey. The sales from the two islands are less than three thousand each year, the great bulk of them going to England. Canada is beginning to take a few, some go to France, and about three hundred come to the United States.

America is taking the best, and paying the highest prices, and with the care taken in breeding in this country, we shall soon, and we might almost say now, have finer animals than the islands can show. They would hardly believe my statements of the yields of some of our cattle. The breeding is not at all worthy of copying, and we have no lessons to learn from them. With some exceptions, the stables are filthy and bad, the cattle are dirty, and not properly cared for. Then, the bulls are used when only twelve months old, and sold off when two years old. I asked the reason of thus sacrificing an animal in his prime, and just when he was in the height of his fame, and had proved of value. Their reasons are, that they get fierce, they get heavy, and as there is a law requiring bull beef to be so marked when sold, and it brings a lower price, that it does not pay to keep him longer than two years. Surely this course pursued steadily of using an immature animal must degenerate the race. Heifers, it is desired to bring in at two years of age, and in the spring and summer, as they sell better for shipping. So that they are constantly selling their animals before they have an opportunity of testing them, and many of the best have left the islands under these circumstances. The prominent, careful breeders seeing this are endeavoring to check it, but the demand is greater now than the supply. Prices are rising, and the farmer is tempted by the prices to part with them. We can supply better stock to-day in this country than can be imported. As only registered or pedigree stock can now be entered in the American Register, this new rule has cut off from coming many of the best stock in Jersey. Consequently the number being limited, the prices have much increased for the eligible ones.

GUERNSEY CATTLE.

What we have said of Jersey may, with equal justice, be applied to Guernsey About the same attention is paid to breeding their stock, but the farmers are more contracted in their views, and generally, if they can use a bull for a shilling they will not pay 5 shillings for a much better one. The result of this is seen in the escutcheons, and the hair of their animals. The one is not as well developed as might be, and the other is not as fine. But the Guernsey cow, we think, is rising rapidly in the estimation of our farmers. She is an animal of larger size, of greater yield, of greater docility, and yields the richest quality of milk. Her butter is self-covered, even in winter, is firm and of beautiful texture, and her golden milk will color that of from six to ten common cows.

THE LANGUAGE.

The language of the people is mixed; many speak French or a Norman-French patois, and many speak both French and English. The language of the courts is French. It is in a measure unwritten French, or French of the past that is spoken by the peasantry; modern French they could hardly understand. But as the communication and business relations are mainly with England, the French will gradually pass away with the incoming of the rising generations.

THE MONEY.

The money in use in Guernsey is of their own currency, and French money, though the hotels and some other payments are required to be in British money. There is a difference between Guernsey and English money of about five per cent., which the buyer with British gold saves. In Jersey it is all on the English money basis, though French money is taken at the discount.

Isolated as are these Channel Islands, each one is a little world within itself, and the American who visits them for the first time seems to be transported backward many years, and is brought near to old time ways. It has that charm as well as a certain novelty, and he enjoys the repose of life as in such strong contrast to that of the modern Babel, London, so recently left. If he has a taste for agriculture and fine stock, he will have a daily treat, and we shall never forget our rides every day, when we would start out at nine o'clock, and not return till six or seven, forced to take repeated lunches with the hospitable farmers we visited. The charming scenery on the coast or inland, the genial climate, the profusion of floral wealth, all were constant pleasure. Every taste may be suited, and find genial employment for every spare hour.

At the conclusion of Mr. Hazard's essay, Professor Roberts read an essay, as follows:

THE SCIENCE OF DEVELOPING AND PERPETUATING MILK QUALITIES

By Professor Roberts.

In the United States for the last two hundred years the almost invariable practice with all farmers producing little or much milk has been to select and rear more or less of the calves from the best milking dams. In this way it was supposed that the good milking qualities of the herd could be perpetuated, and many were so sanguine as to look for improvement. Sometimes it occurred that the offspring proved to be as good, or even better, than their dams; but in a large majority of cases they were inferior. This practice of selecting offspring of the best dams, with little or no thought or pains as to their qualities—either apparent or inherited from the sire—has been in practice for a long time, and yet our common cattle are neither a breed, a sub-breed, nor good grades, but are much inferior, as a whole, to the European breeds from which they sprang.

Success in developing and perpetuating a milking breed is certainly not by simple selection on the dam's side only—though it is, I admit, a small factor of the sum total—but those who use this method alone will constantly meet with failure, and be doomed to labor for the merest pittance, and in the end be distanced in the race. In this age of rapid progress and sharp competition, if the farmer is to have his just share of the profits, he must think quickly and intelligently, get at the roots of things, study cause and effect, and join science with practice. We have met with failure. Don't let us be too proud to own it. The cattle on a large majority of our farms are living witnesses against our methods, or lack of methods. We have cheap lands, nutritious grasses, abundant grain, a pure climate, plenty of cheap building material, and intelligent free labor; yet failure is written almost anywhere you choose to look for it. See it in the concentric circles of the horns of the superannuated cow. See it in the bull-headed, thick-necked heifer. See it in the gothic-ribbed, pot-bellied, narrow-chested cat-hammed calf. See it in the weak-constitutioned yearling, as it shivers at the watering-trough. See it in the contracted udder and attenuated stream of milk that is ever pounding on the bottom of the milk-pail. And, lastly, see it in the ledger:

Dr. to labor and food	$60
Cr. by milk and carcass	50
Amount to balance	Failure

I do not mean to say that each individual animal of our common stock is a failure, but I do know that a majority of them fail to pay for their care and food, and give a fair profit.

The farmers of the northern portion of the Kingdom of the Netherlands wanted just such an animal as many of our own farmers want to-day; a sizable, fair, beef animal, with uniformly good milking qualities. They accomplished their object right well, long years since; while we, with equally as good material for the last fifty years, and far better surroundings in many respects, have frittered away our time and energies. Meanwhile we have imported, at great expense and risk, large numbers of valuable animals; yet, in most cases, the common cow shows no improvement, save what would occur from improved surroundings. In our earlier history men were excusable for neglecting to improve their cattle; but for the last fifty years, most of the cis-Mississippi States have been prepared to care for and maintain improved animals, and there is now no excuse for longer pursuing the haphazard, unprofitable method of the past. One of the prominent causes of failure to develop and maintain improved animals has been the ignoring of the first and great law of breeding. Without vigor, health, and vitality, the power to transmit properties is seriously weakened. If the vitality of the dam, while bearing and sustaining her young, is largely drawn upon by labor, as is frequently the case with the mare, or by an excessive flow of milk, as in the best cows, their prepotency is injured, and valuable acquired qualities fail to descend to the offspring in full force through the impoverished blood of the dam. Therefore the vitality and qualities, both inherited and acquired, of the sire, become of paramount importance. So long as a little present trouble and expense is saved, this vital law appears to be lost sight of or ignored, judging from the too frequent practice of using a half-blood, a quarter-blood, or no blood at all; falsely reasoning that if the dam is superior the offspring of necessity must be, though begotten by a sire modeled after a hat-rack.

Another prominent cause of failure has been a lack of nourishing and succulent food at critical periods. The cows are usually bred in July and August; there is then most certain to be upon us a drought, with scanty, dry pastures. Just at the critical period, when the dam has to build up the embryo and make provisions for its future development and sustenance, the food of the dam diminishes, water is deficient, or a long way off, the flies annoy, the scorching sun arrests grazing, and the result of all this is soon seen in the diminution of the milk, falling sometimes one-half in a single month. Again, later in the fall, between grass and hay, when the enervated cow feels most keenly the cold rains and sharp winds, and the system needs additional nourishment and heat, her food is frequently the most innutritious and scanty. A scanty supply of "washy" frost-bitten grass, and on rare occasions the straw-stack to run to, is considered ample, for "she'll dry up anyhow; what's the use?"

Parenthetically, let me say, the number who do not thus inhumanly treat their cattle is increasing, and may it be yearly augmented.

The acquired tendency to produce milk at this season of the year struggles for a few weeks with the normal tendency to store up fat for the winter, but finally yields to the stronger tendency in animal nature, self-preservation, and for the next four months the cow is unproductive. With such treatment, the simple selecting and rearing of the most promising calves, even though their sires have superexcellent qualities, will never result in developing and perpetuating fine milking qualities.

Shelter and care are also prominent factors in breeding and in improving desirable qualities. Because it is warm to-day little or no provision is made for the morrow, but to-morrow brings a chilly rain-storm with a temperature little, if any, above freezing, or snow squalls, accompanied by a brisk northwester that pierces to the very marrow. The attenuated, half-nourished cow shakes her head and arches her back, that as little surface as possible may be exposed, and shivers and suffers in the pitiless storm; while the farmer, in his great-coat, contemplates the scene with no thoughts that there is anything amiss, improvident, or cruel in all this. His mind is just now hard at work in the mental process of getting at the sum total of oats, corn, and hay; that by his false economy he will be enabled to sell. As he slaps his hands to warm them he exclaims, "Good! good!" and forgets the poverty of his cattle and his farm as well as the words of Solomon.

Development and perpetuation of good milking qualities are not found on the north side of a rail fence in November. Neither are they produced, though we breed in-and-in with the greatest nicety, and infuse all of the combined improved blood of the Kingdoms of Great Britain and the Netherlands, and select with the most discriminating judgment the best heifers, if suitable and abundant food, care, and shelter are lacking.

Our common cattle are the result of selection of the best, at least on the female side, for a hundred years. For fifty we have, to a great extent, infused into their veins the best blood of Europe; in fact, they are at the present time simply cross-bred animals, and in their veins courses no blood but that of an ancestry far superior to themselves. Many of them are inbred, the grandson and the son standing at the head of the herd sired by their sire; and yet the average common cow is a failure, an humiliating failure. Upward of ten millions of them are in the dairy, and the forthcoming census report puts down the yield at 125 pounds of butter per cow, which is, without doubt, too high. Allowing 20 cents per pound to be the average price received by the farmer, and adding one dollar, the price at which the calf is usually sold, the total gross receipts per cow are $26. The cow herself in the fall is worth scarcely as much more.

Humiliating failure! Financial failure! These cattle should be renamed: they are not natives. I have called them common cows, but they are very uncommon. Since they are worth so little themselves, let's give them a big name. How would "Anti-financial, Anti-monopoly" do? But hold! I am not so sure of the last part of the name. For every one of these cows there is invested $100 in land and $20 more in buildings, tools, and apparatus. The ten million cows are estimated to be worth $300,000,000: the land necessary to support them is worth $1,000,000,000; the factories, extra buildings, tools, &c., cost $200,000,000; or the total investment for dairy purposes is placed at $1,500,000,000. The name "Anti-monopoly" will never do. The average yield of the State of New York is said to be larger than that of the entire country; but no one places it at more than 150 pounds of butter per cow per year, while most estimates give it at not more than 135 to 140 pounds. Taking the highest estimate, and allowing 25 cents as the average price of butter at the farm, adding $1 for the calf, makes the total gross yearly average receipts per cow $38.50. If we divide them into three classes, according to merit, we should probably find the first class of 500,000 cows producing 200 pounds per cow, or $50, and the second class of 500,000 producing 150 pounds, or $37.50, and the third class of 500,000 producing 100 pounds, or $25. There are, without doubt, in the State of New York at the present time 1,000,000 cows, the average income from which does not exceed $32 per cow, calf included, or each individual cow brings in less than 10 cents per day. Certainly the average common cow of New York, though making a better showing than the cows of the entire country, is far from being the animal we should and can have. When we compute the entire dairy products of our country the sum total is very large, and we like to brag a little over it. Five hundred millions of dollars is a good round sum; but in order to reach it all the phenomenal cows, all the gilt-edged butter, and all the milk sold at high prices, and all consumed on the farm, must be counted in, as well as all the pigs and calves partly raised on the by-products, and yet the entire product of each is less than 14 cents per day. When we bring the equitable portion of this enormous sum due to each animal, and place it in the farmer's pocket, it takes all the spread-eagle out of it.

After having said so much in regard to the failure in breeding the common cow, I would call attention to the thoroughbreds or pedigree cattle. A portion of them are utterly worthless; even worse than that, they are a positive damage to the country. They are degenerate, effeminate, sickly sons of a noble ancestry; living witnesses of the results of ignorance, starvation, and suffering. They are far less valuable than grades, for they introduce the worst of all evils—weak constitution. They are usually sold to dairymen at low figures, as they are considered good enough to beget grades. Their lack of vigor, symmetry, and potency is supposed to be made up by the length of their pedigree; but, write it never so long, trace their lineage back to the time of the Cæsars, embody in them all the names of the great warriors and statesmen of ancient times, they are still, to use an expressive term, "scrubs." Success lies not through the culls of badly-selected and poorly-kept herds of thoroughbreds.

There are many thousand thoroughbreds of the various breeds in our country, yet the total number of males would be but a small fraction of the number required were no others used. This being the case, the first question to be decided by those wishing to improve their cattle, by the economical method of introducing improved qualities through the blood of the sire, is the individual animal or sire under consideration superior to the herd? Even though the animal be young, want of vitality or faulty conformation may be readily detected. Second. Were the parents superior; then the grandparents? The farther back we reach, finding no faulty ancestry, the more valuable the individual animal becomes.

But pedigrees are usually so recorded that nothing is really known of the qualities or performance, good or bad, except in a few cases, and the purchaser is left to form his judgment without the necessary knowledge to do so intelligently. In rare cases, the sire and dam of the animal under consideration may be at hand for inspection, but seldom are there at hand any recorded facts as to growth or performance. A single illustrious ancestor, many generations back, is not sufficient; for who may know how many of the causes of degeneracy have since done their work?

We will suppose the sire to have been judiciously selected and marked seven, ten being the maximum. He is bred to cows inferior to himself, marked five. The offspring—supposing for the present that the potency of the parents is equal—is marked six, a gain of 16⅔ per cent. The practice of the idea embodied in this supposed case is and has been carried out by thousands of dairymen, and yet little or no improvement resulted, because what was gained by the introduction of better blood was lost for want of proper and sufficient food, shelter, and care. The addition of qualities represented by one is lost, and they may now be represented by five, the original number of the inferior parent. Of all the causes of failure, this is, perhaps, the most prominent, and here is the mistake that is most frequently made.

Suppose that instead of neglect, better care, food, and shelter had been given, and thus valuable qualities represented by one had been added, the standard would then be seven, and the quality of the offspring would not then be half way between the parents, but equal to the superior sire. The owner's knowledge has now increased with the improvement of his cattle, and he purchases a male superior to his last, which we will mark eight; and, supposing the potency as before, the female standing at seven, the offspring would be marked seven and one-half. There are now qualities represented by only half of a unit to be added by improved surroundings, in order that the offspring shall be equal to the superior sire.

The average animal is as exact an index of the causes and elements that have entered into his being as the thermometer is of temperature. The effects can never be greater than the causes which produce them. Causes sometimes beyond our knowledge and control produce variation in animals of like parentage and give an opportunity, by selection, of eliminating, to some extent, undesirable tendencies. Taking advantage of this fact, improvement can be accelerated by selection, though it would go on, but more slowly, if no selection were made, provided improved blood and conditions were augmented. Selection is but one factor in improvement, and, as we have learned to our cost, but a very small one, unless others are joined to it.

The age and physical condition of the parents has so much to do with the offspring that they almost defy selection and pedigrees. If two immature yearlings are coupled, the result must be inferiority in the offspring, and the results are scarcely better when the parents are superannuated. The female should produce offspring at an early age, even thrice a mother before she is matured, in order that her pliable nature may be molded and her milking qualities augmented and fastened by artificial means. After she is mature, and all possible means compatible with health and vigor have been used to increase her milking tendencies, she is in a condition to perpetuate her valuable qualities through her offspring with very great certainty, provided the conditions are slightly changed. Instead of now aiming to get the greatest possible flow of milk, the primary aim should be to protect the welfare of the offspring. Her food should be not too succulent but abundant and nutritious; the period of milking should be shortened to eight months, and after having produced three or four calves under these conditions, she should be fattened and sent to the block before she reaches her ninth year; her carcass paying over one-third the value of all the food she has ever consumed. If the cow was a superior one, the common practice at present is to first get all the milk that is possible, to keep her as long as she will breed, raising all of her female offspring, and then the wonder is why the dairy is not improved. The fact is forgotten that immature or superannuated animals cannot transmit their acquired qualities in full vigor and force. I wish I could make this more emphatic, for just here lies a large element of our past failures.

What is true of the dam as to maturity, vigor, and health, is equally true of the sire, and through him, as between the two parents, the greater element of improvement is found. For if rightly used, his vigor and vitality are not endangered, but are preserved in full force long after the dam's. But if his vigor is sapped when a mere calf, and his life is spent in the foul and filthy odors of solitary confinement, without exercise or the vivifying sunlight, the element of improvement will ever stand at zero. By the methods now too common we may continue to purchase thoroughbred sires and be always improving, yet never improved.

We could learn valuable lessons from the breeders of thoroughbred horses, if we would. The stallion is fed, clothed, exercised, and molded with all the skill and care of experts. The dams are left to feed on nutritious grasses, and to run the fields at will. The result is, that the desired qualities are so fixed and improved that it is no uncommon thing for farmers to pay more for the services of the stallion than the value of the mare to which he is bred. The result shows that their confidence is not misplaced, for if the dam, though of mixed blood, be passably good and placed under favorable conditions, the offspring is certain to be, at least, a superior roadster. But if the dam is overworked, insufficiently fed, and abused, the result is just what we see in the mixed-blood farm-horse.

The professional horse-breeder has learned his business while the ordinary farmer is ever repeating the same expensive mistakes in breeding horses that the dairymen are in breeding milch cows.

Having at some length discussed the elements that enter into success and failure, we will gather together the factors of success and place them in a more concentrated form. Select the best animals attainable, consistent with the surroundings, means, and knowledge possessed. Test their qualities by actual performance, and use the information gained to make a second and more careful selection. Decide to raise milch cows, and not to purchase them. Rear only those calves that are from mature, vigorous, healthy parents, properly nourished, comfortably housed, and kindly treated, that the potency and qualities of the parents may descend to the offspring. Augment valuable qualities by careful milking at regular periods and by using all the factors at hand necessary to mold the young animal to the required uses, and cause it to increase in value from the day of its birth to the days of its death. Improvement of the milk qualities of our common cattle is certain and rapid, if all the means I have pointed out are used simultaneously. There is certainly no secret or hard problem in the science of development; the only question is, how to set in motion superior causes, that we may attain superior results.

So far I have said nothing in regard to in-breeding as a means of development, because so long as the purchased sires are equal or superior to those of our own breeding and of like characteristics, and can be procured at reasonable prices, I can see nothing gained by the practice; for I cannot comprehend the mathematics that divides the sum of two and two by two and calls the answer two and a fraction. To illustrate, let us suppose that we have a male and female of identical parentage, or own brother and sister, and that their blood is 127 parts pure, or improved blood, and one part inferior. The offspring of these two animals will have the one part of inferior blood in 128, and the operation may be repeated *ad infinitum* and the one part of inferior blood remains and can never be eliminated by in-breeding. It is and must remain one factor of the 128 that produce the results, and that factor is quite as likely to be as potent as any other one of equal size. The remoteness of the origin of the inferior blood does not help matters, for the origin of the improved blood is alike remote. Some other method of eliminating the inferior blood must be used, as in-breeding can never do it. If the practice of using pure or improved blood on one side be continued, in time the factor of inferior blood will be so small that practically it will be of no account; but even by this method, a fraction must always remain. If we choose, this small fraction may be entirely eliminated, but not by in-breeding or grading up. If the conditions of the animal are improved, the blood or quality is improved, and thus the inferior qualities eliminated.

In-breeding *per se* can never result in improvement. The wild horse and buffalo are no better to-day than they were a thousand years ago, unless their conditions have changed. By in-breeding, the expert may make some advance by selection; but usually the loss by unavoidable mistakes in feeding and management will more than counterbalance the gain.

We look in vain for an improved breed formed by using the two factors alone. All that may be accomplished by them, unassisted, is to make each individual animal a nearer type of the average qualities of the two or more animals selected for the foundation of the herd or breed. What is gained by selection is ordinarily lost by mistakes in feeding and care. The selected animal is only the expression of the potency of the parents in their most perfect condition. In other words, the result is uniformity, not increase in production, though the animals may command a higher price on account of such uniformity.

Having used all the means necessary to produce rapid development of valuable qualities, and having arrived at perfection, or as near it as possible, how shall the improvement be perpetuated?

It is only necessary to say that the same means used to improve qualities may be employed as far as practicable, to perpetuate them. If the family or breed is superior to all others, there is no way to perpetuate acquired qualities but by in-breeding of families or individuals. This is what Bakewell did, but not till he had so improved his sheep by purchasing the best animals of his neighbors, and by high feeding they were superior to all others. But had his neighbors been doing the same thing, and had they met with like success, he might have made selections from their flocks and thus have avoided the just criticism that his sheep were delicate in constitution and largely composed of fat. Collings and Bates were of the Bakewell school, and largely followed his methods. Charles Colling purchased among other superior cows, one called Stanwick, rechristened Duchess; she is described as being "a massive short-legged beast, breast near the ground, a great grower, with wide back, and of a beautiful yellowish red, flaked color." Is there a Duchess cow to-day that can fill this description? Is there any evidence that Collings or Bates ever obtained a better one of this family by in-breeding?

Mr. Bates purchased Duchess by Daisy Bull, calved in 1800, and also, in 1810, Duchess by Comet. Thirty-one years after the birth of his first Duchess, we find the total number of females of this family bred by him, as recorded in the Herd-Book, to be thirty-two. Meanwhile the results of his in-breeding were so unsatisfactory to himself that he offered Charles Colling $500 for the services of his white bull (151). In 1831, Mr. Bates introduces new blood through Belvidere (1706), and soon is produced the Duke of Northumberland (1940), a bull that has never been excelled, if ever equaled. Mr. Bates continued to breed in-and-in for forty years, and at the end of that time there is recorded 64 Duchess females. Supposing every third calf to be a [illegible]male, and that they bred at two years old, and then throw off 50 per cent. for death failures, we should have 2,286 females of the Duchess tribe. I do not desire to disparage in the least the inestimable benefits conferred by Bakewell, Collings, and Bates, but only to show that no improvement in increased productive qualities resulted from in or close breeding. After they had reached their ideal, and had bred animals, as they believed, superior to all others, they endeavored to perpetuate their qualities without recourse to animals outside of the families which had been one of the great factors in the improvement. If this family of Duchess cattle were superior to all others, then the practice of Mr. Bates was the correct one.

I do not care to discuss here whether the acquired qualities can all be perpetuated indefinitely by in-breeding, and whether they may not deteriorate, in time, through the mistakes of the breeder. The practical question for the breeder, at any time, is; Are the cattle of my own breeding better than others? If so, breed-in-and-in. If inferior, then purchase males of those who have been more successful—who have the superior ones.

Finally, in order to perpetuate the milk qualities of a family or breed, the animals must be kept under as favorable circumstances as were those under which the qualities were developed. The selected offspring must be the embodiment of the parents when at their best. The qualities of the sire must never fall below the standard reached, and it matters little whether he be in-bred or "out-bred."

At the conclusion of Professor Roberts' essay President Loring delivered the following address:

ADDRESS ON DAIRY FARMING.

GENTLEMEN: The value of the animal industry of this country has hardly received the estimate to which it is entitled. The universal presence of our domesticated animals has so familiarized us with their existence that we have allowed ourselves to underestimate the importance of the great branch of farming which they represent. We all know that farming without them is an impossibility; and we believe faithfully in the old French proverb, "No cattle, no farming; few cattle, poor farming; many cattle, good farming." From the earliest records of agriculture until now the relations of cattle to the farm have been discussed, and the breeding and feeding of cattle has occupied the attention of the most skillful and intelligent farmers. I doubt if the reason of man in the management of the business of deriving a subsistence from agriculture in its various branches has ever displayed itself more strikingly than it has in the relation, improvement, and care of those breeds of animals which are adapted to his use and from which he draws so large a part of his comfort, convenience, and actual subsistence. There have been inventors, many investigators whose labors have been of vast advantage to the cultivation of the soil. But none of them have performed more important service than they who, by a careful application of the best rules of breeding and feeding, have established valuable families of animals especially adapted to the purpose to which they were assigned—Bakewell and Colling among cattle, our own Hammond, the great improver of fine wooled sheep—the sagacious breeder who laid the foundation of the great family of American merinos.

The question of the raising of cattle with the cost in quantity and the kind of food, and the breeds best suited to different purposes, includes the whole system of cattle husbandry, and is a matter of the deepest importance to every farmer. There is no branch of husbandry so universal, none more capable of yielding fair profits, none more important, none more dependent on good farming, and none more likely to be attended by good farming, when properly pursued. Wherever man resides, whether civilized or savage, whether roaming or stationary, whether on mountain pasture or in cultivated and luxuriant valleys, in good farming regions and in poor, and in every spot where grass grows for cattle "and herbs for the service of man, then the herd attends him and supplies him with food and labor and clothing, and the means of tilling the earth."

By the statistical returns of the census of 1880, there are in the United States 10,356,993 horses, 1,814,368 asses and mules, 999,092 working oxen, 12,442,137 milch cows, 22,466,562 other cattle, 51,183,903 sheep, and 47,688,371 swine. Of these the increase has been in milch cows between 1870 and 1880 from 8,935,332 to 12,402,137; of other cattle from 13,566,005 to 22,466,532; the aggregate of cattle in 1870 was 23,830,608, and in 1880, 35,877,791, an increase of 12,057,183. In the ten Northwestern States the increase in milch cows has been quite extraordinary in the last ten years. In Michigan the increase from 1870 to 1880 was from 250,859 to 384,573; in Ohio, from 654,390 to 767,044: in Indiana, from 393,736 to 504,944; in Illinois, from 640,321 to 865,915; in Wisconsin, from 308,377 to 478,376; in Minnesota, from 121,467 to 275,539; in Iowa, from 369,811 to 854,097; in Missouri. from 398,515 to 661,405; in Kansas, from 123,440 to 418,333; in Nebraska, from 28,940 to 151,609; the aggregate being from 3,289,856 to 5,371,831 or an increase of 63.3 per cent.

These figures indicate the value and importance of the dairy interest which this convention represents. This interest in the Northwest has been a marvel of progress during the last ten years. It was a great surprise, received at first with incredulity and distrust, when, at the Centennial Exposition, the palm for superior butter was awarded to Iowa. But it was not an accident. In Iowa, in Illinois, in Wisconsin, creameries came into existence, acquired prestige, and commanded prices even above the rates for the standard goods of popular Eastern establishments. Only the fancy brands, the product of a few popular dairies, which command extraordinary prices from wealthy and fastidious purchasers, bear higher prices than the best butter of the Northwest, and a few popular creameries readily obtain to-day from two to four cents more than Eastern dairies of a high grade.

Ten years ago there were more than 3,000,000 milch cows in the ten States of the Ohio Valley and the trans-Mississippi. They are called "milch cows," but with the exception of the Western Reserve, and scattered dairies in the Northwest, milk and butter products were consumed on the farm or in its neighborhood. There has been in ten years in this territory an increase of more than 2,000,000 cows, but comparison of numbers feebly indicates the great advance in the production of butter and cheese. The best milking breeds have been introduced, selection of individuals has resulted in great improvement, and the milk yield has greatly increased, while the animals receive better fare, and skill and science have been invoked in the manufacture. In many districts a new industry has been created in a single decade, in all great improvement in the quantity of milk, quality of product, and the profit in marketing has resulted.

There has been an advance of the dairy interest in all sections of the country, but the enlargement in the West has been more than double that of the East, and in volume vastly greater than the improvement at the South.

In 1870 the aggregate amount produced annually was: Of butter, 514,092,683 pounds; of cheese, 53,492,153 pounds; of milk, 235,500,599 gallons, sold in the market and factories. In 1880 the products of the dairy had increased nearly three-fold, and milk had increased more than two-fold, as the following table will show:

		Yield in 1870.	Approximate yield in 1880.
MICHIGAN.			
Butter	pounds..	24,400,185	73,200,355
Cheese	do.....	670,804	2,012,412
Milk	gallons..	2,277,822	4,555,644
OHIO.			
Butter	pounds..	50,266,372	100,533,754
Cheese	do.....	8,169,048	26,507,144
Milk	gallons..	22,275,304	44,550,608
ILLINOIS.			
Butter	pounds..	36,083,405	108,250,215
Cheese	do.....	1,661,703	4,984,109
Milk	gallons..	9,258,545	18,517,090
INDIANA.			
Butter	pounds..	22,915,385	68,746,155
Cheese	do.....	283,807	851,421
Milk	gallons..	936,983	1,873,966
IOWA.			
Butter	pounds..	25,512,179	76,536,537
Cheese	do.....	1,087,741	3,231,523
Milk	gallons..	628,800	1,377,600

Turning to the eastern section we find the following interesting figures accurately compiled in the census of 1880:

1870.	New York, cows		1,350,661
1880.	New York, cows		1,437,855
	Increase, 6¼ per cent.		
1870.	Butter of farm dairies	pounds..	107,147,526
	Cheese	do....	22,769,964
	Milk sold in market	gallons..	135,775,919
	In all equivalent to 483,813,465 gallons of milk.		
	Average per cow, 358 gallons.		

188. BuOtter of farm dairies	pounds	111,922,403
Cheese	do	8,362,590
Milk sold	gallons	231,965,533

In all equivalent to 577,339,097 gallons.
Average per cow, 402 gallons.

Vermont, 1870, cows	180,285
1880, cows	217,033
Increase	36,748

Or 20 per cent.

1870. Butter of farm dairies,	pounds	17,844,396
Cheese,	do	4,830,700
Milk sold	gallons	3,835,840
In all equivalent to	do	53,104,844
Average per cow	do	295

1880. Butter of farm dairies	pounds	25,240,626
Cheese	do	1,545,780
Milk sold	gallons	6,526,550
In all equivalent to	do	84,053,848
Avearage per cow	do	388

In 1880, Massachusetts produced 6,559,161 pounds of butter; 2,245,873 pounds of cheese; and 15,254,057 gallons of milk sold, being exceeded in this product only by New York and Ohio.

These figures will indicate the great value of the dairy, and the product of milk produced for the daily market, and the importance of this convention as representing a great and widely diffused industry, and called for the purpose of obtaining and imparting information to the farming community. For myself, having laid before you the magnitude of the dairy interest, I beg your indulgence while I submit a few suggestions with regard to dairy cattle.

Many years ago a writer in the Library of Useful Knowledge remarked:

"At the outset of his career the farmer should have a clear and determined conception of the object which he wishes to accomplish. He should consider the nature of his farm; the quality, abundance, or deficiency of his pasturage; the character of the soil, the season of the year when he will have plenty or a deficiency of food, the locality of his farm, the market to which he has access, and the produce which can be disposed of with the greatest profit, and these things will at once point to him the breed he should be solicitous to obtain. The man of wealth and patriotism may have more extensive views, and nobly look to the general improvement of cattle; but the farmer with his limited means, and with the claims that press upon him, regards his cattle as a valuable portion of his property, and on which everything should appear to be in natural keeping, and be turned to the best advantage. The best animal for him is that which suits his farm the best, and with a view to this he studies or ought to study the points and qualities of his own cattle and those of others. The dairy-man will regard the quantity of milk,—the qualtity,—its value for the production of butter and cheese,—the time the cow continues in milk—the character of the breed for quietness or as being good nurses, the predisposition to garget, or other disease, or dropping after calving,—the natural tendency to turn everything to nutriment,—the ease with which she is fattened when given up as a milker, and the proportion of food requisite to keep her in full milk or to fatten her when dry. The grazier will consider the kind of animal most in demand in his neighborhood, the early maturity, the quickness of fattening at any age, the quality of the meat, the parts on which the flesh and fat are particularly laid, and, more than all, the hardihood and the adaptation to soil and climate."

There is one fact, however, which the breeder occasionally forgets, but which is of as much importance to the permanent value of his stock as any careful selection of animals can be, and that is good keeping. All good stock must be raised with care and well fed. It is necessary that these two essentials in this species of improvement should always accompany each other; for without good resources of keeping it would be vain to attempt supporting a valauble stock. It is yet more evident when animals are absurdly brought from a better to a poorer soil. The original stock will deteriorate if neglected, and the improved breed will lose ground even more rapidly and to a far greater extent.

That there is a steady improvement going on in the raising of dairy stock, the figures I have laid before you show conclusively, and yet there is great room for improvement in this direction. Sufficient care is not always used in selecting the female in the first place. A cow that happens to be a good milker, in spite of many bad points, and without any known ancestry, is expected to be valuable to the farmer's herd. A large cow is selected for the foundation of a herd of heavy cattle—her size being often her only recommendation. She may be a bad feeder, a bad handler, a bad mover, in fact deficient in those very points which render an animal fit for the stall. She disappoints our expectations.

I will not discuss the raising of beef-cattle, with which every Western farmer is familiar, and which is a comparatively simple and easy branch of this business. The production of a herd of short-horned steers of uniform quality and size is not difficult—the shape and structure, and the fat-producing organs being easily transmitted and easily preserved. The raising of dairy stock, however, is more difficult. The organization of a good milking cow is very delicate, easily disturbed, and not easy to transmit. The whole system of milk-producing organs is so sensitive that many causes may prevent its transmission, and many causes may injure its operation after it is transmitted. A sudden chill, a severe thunder-storm, change of food, fright, abuse, may harm but little a thrifty steer on a hill-side pasture, but any one of them may seriously injure a good cow grazing by his side. We should not forget this if we would anticipate our many disappointments and bear them philosophically. We can, however, select good cows for our herds, and exercise judgment and care in breeding from them, always remembering that no matter what the yield of milk from a cow may be, she should not be selected for a breeder unless she possesses as an inheritance that shape which indicates strong vitality and that quality which indicates active secretory junctions. In her well-shaped strong head, wide muzzle, mild clear eye, broad forehead, small waxy horn, slender neck, straight and slender fore-leg, sharp chine, loose shoulder, broad rib, open-jointed back-bone, mellow skin, preponderating hind quarters, long hind foot and broad fore foot, ample carcass, well shaped udder, large superficial veins, soft hair, she should indicate a capacity for converting food into milk as distinguished from that cow whose rounder and fuller form and heavier bone and smoother joints and narrow head and heavier quarters show an especial aptitude to take on fat.

A good dairy cow should possess the appearance of strength and firmness without being too compact, and she should possess no palpably weak point if she is expected to endure well in the work of the dairy. But after the most careful selection it will be found extremely difficult to produce a dairy herd of uniform excellence or of uniform quality. In this respect the most remarkable dairy breeds fail lamentably. The Ayrshire farmer has been engaged for nearly a century in establishing a breed of animals which should conform to the description I have given of a dairy cow, and should possess the faculty of transmitting the best qualities in their full vigor. In this work he has evidently engrafted on the west Highland cattle the blood of many well-known English breeds, more especially the Jersey and short-horn. He has succeeded in creating a good dairy cow, but he has not succeeded in giving his breed of cattle that uniformity of shape and color and quality which makes a breed valuable. He has established analogy but not uniformity. He has secured certain qualities of a good cow contained in animals of every variety of color, size, shape, function, the best of which are good enough for the most critical and ambitious dairy farmer, and the poorest of which are of but little value either for the dairy or the stall. The standard type of this cow is so good that when all other praise of a good medium sized animal is exhausted, the finishing touch is made in the expression, "She is as good as an Ayrshire." The other most important dairy breed is the Jersey—a breed produced in a narrow territory and so carefully bred for generations that there can be no doubt of the purity of the blood. The peculiarities of this animal are always preserved; but closely bred as they are, resembling each other in color, and shape, and texture, and function, they vary in their dairy qualities fully as much as the Ayrshire. From these two illustrations I have inferred that the breeding of good dairy cows could only be done by such judicious crosses as will secure the desired shape and quality, with the expectation that a large proportion of the attempts to produce what is wanted will fail. So far as I have been able to judge, certain grade short-horn families make the best foundation of a dairy herd; and crossing them with good Jersey blood will produce a larger proportion of good cows than any process of breeding, pure or mixed, which I have seen. The cow produced by this cross possesses a large share of those points I have laid down as belonging to a good cow. In this way an inexpensive mode of breeding is secured, and the fruits are obtained at so economical a rate that the rejected animal can without loss be turned to the market for beef.

I have already said that it is comparatively an easy matter to breed animals, which, by their aptitude to fatten, will remunerate the feeder. The qualities belonging to an animal structure designed for this purpose are very perceptible and easily transmitted, and are easily preserved and improved by feeding. Mr. Bakewell learned almost the precise mechanism adapted to his wants as a producer of size and fat; the form and quality of bone; the shape of the parts containing the vital organs and the organs of nutrition; that "feel" which an expert understands so that he may almost be said to carry eyes in his fingers' ends, capable of exploring the internal organization of every animal. And this bone and shape of the body and texture of the skin are easily preserved and transmitted. Breeding does much and feeding does more towards this preservation and transmission. When Mr. Colling saw Hubbard he knew that his stomach and glandular system and nervous organization all tended toward the development of fat, and he believed it would be easy to transplant such lethargic faculties. He did this on good soil, and with proper care, in making a creation of fat. Mr. Aiton and his predecessors had a very different and a much more difficult task to perform. That delicate organization which is called into operation when the food taken into the stomach is to be converted into milk, is much more difficult to comprehend or control. True, there is a certain physical conformation indicative of a large capacity for secreting milk, but when we remember that this capacity violates all law we can comprehend how many difficulties they labored under who in Scotland endeavored to establish a breed of milkers. They might secure the bony structure, the quality of the skin, the shape of the muscle, the general outline, the form of udder most approved, and after all this there might be some defect in the powers of assimilating the food in the glandular system, in the nervous organization, which entirely destroyed the utility of the animal. This accounts for the wide differences which exist in individuals belonging to every well-known and long-established breed of milkers, such as the Jerseys and Ayrshires.

Now, it would seem that the great rule to be observed in the rearing of dairy stock is not to interfere with the delicate organization by the food furnished in early life. Why cannot the system of a heifer be injured by food so as to disorganize her glandular functions, as well as the system of a cow which can be forced into diseased action with the greatest ease? Why may we not, for instance, lay the foundation of garget long before the udder contains a drop of milk? We do not feed a milch cow as we do a fattening cow, unless we are willing to run the risk of ruining her. For the wholesale statement so often made that what produces milk will also produce fat, and *vice versa*, is shown to be wholly unfounded by a comparison of the effects of rowen hay, brewers' grains, fine feed, and green food, with corn meal and oil-cake.

A dairy cow, moreover, never reaches perfection in her line until she has arrived at maturity; and she must reach this period of life with all her faculties unimpaired, if we expect her to be as good a cow as nature intended her to be. She differs in this respect from the best beef-growing animals, which are mature, as it were, from the start, and whose organizations, instead of being impaired for their business by generations of high early feeding, are rather more and more adapted to it. We all know that the oldest and best families of short-horns are not remarkable for constitutional elasticity and vigor. They have not great muscular strength, are not nervous and powerful in their actions, and are deficient in the procreative faculties. Like the thoroughbred horse, which has also been forced to early maturity and early decay for many generations, they have become enervated and constitutionally delicate. High feeding has done this in both instances, and as "a short life and a merry one" in the animal is most profitable to the breeder of beef and horses fit only for the turf, high feeding has accomplished what was desired, the gain being greater than the sacrifice. Not so, however, with the cow. Her powers mature slowly and depend very much on the strength of her constitution. When this is impaired her value is diminished. For in the work of giving milk in which her whole life is passed the tax upon her vital forces is such that none but the most robust can endure it. In establishing a dairy breed, therefore, early maturity with its accompanying evils is not desirable. On the contrary it should be avoided, and that mode of feeding should be adopted which will be conducive to health in the individual and in the breed, and which will in no way exhaust the powers and shorten the life of the race.

In addition to this, great regard should be had in raising dairy stock to the effect which different kinds of food produce upon the animal economy. Whatever enlarges the bony structure of the female calf beyond what is necessary for her strength is worse than useless. A coarse-boned cow rarely reaches that standard of excellence both in the quantity and quality of her milk which is attractive to the breeder or satisfactory to the consumer. So, too, of fat. The fat cells, that tissue of the body in which adipose matter is deposited, are found in fat and lean animals alike—the difference consisting in the amount of their contents and their number only. For the supply of fat certain organs are provided which are capable of receiving all that excess of non-azotized compounds, such as starch, oil, &c., which is contained in the elementary matter taken into the body. Where there is a ready absorption of these compounds into the vessels, fat is produced, especially if with this absorption there is combined a vigorous power to generate adipose tissue. When they are not absorbed, accumulations of fat do not take place; and when they are absorbed, without being provided with adipose tissue they would accumulate injuriously in the blood, if not drawn off by the liver. Hence it is that in warm climates where there is diminished excretion through the lungs, and non-azotized food is not got rid of by the respiratory process the liver is overworked, its functions become disordered from its inability to separate from the blood all that it should draw off, and these injurious substances, accumulating in the blood, produce various symptoms that are known under the general term bilious.

I have dwelt on the production of animal fat and the organs engaged in its manufacture in order to show how distinct a part of the animal economy it is, and how naturally the fat-producing functions can be transmitted independently of all others, and may be cultivated at the expense of all others.

The secretion of milk is a very different matter, and is performed by certain glands whose business it is rather to elaborate from the blood certain products which are destined for the special uses in the economy, and to eliminate matters whose retention in the circulating current would be injurious. Be it as it may, the production of milk is a very different business from the production of fat, and does not result in a combination of the same elements as are contained in the adispose tissue and fat cells.

It is well known, moreover, that the proportion of two at least of the principal ingredients of milk is liable to great variation with the circumstances of the animal. Exercise and cold by increasing the respiration eliminate part of the oily matter in the form of carbonic acid and water; while rest and warmth by diminishing the drain favor its passage into the milk. The proportion of caseine on the other hand is increased by exercise; which would seem to show that this ingredient is derived from the disintegration of muscular tissue. The experience of every farmer teaches him that an animal which has a large, heavy, muscular development, and is thus furnished with the means of rapid locomotion is seldom a good milker. Her digestive apparatus is more devoted to her fleshy fiber than to the preparation of milk. The same may be said of fat and bone. So true is that, in countries where the bone and muscle of the cow are developed by labor, her service in the dairy amounts to but little.

It would seem, therefore, that in rearing animals for the dairy care should be taken that the young are not so fed as to develop a tendency to great size either in frame or in adipose tissue, or so as to establish in the end a race which has every faculty except that of producing milk. I would not advocate a deficiency of food for young dairy stock, but I would argue against an excess of articles of a highly stimulating quality. The plan of the Scotch farmer is undoubtedly a good one—to take their calves early from the dam, feed them from the dish, and bring them to solid food or pasture as soon as the condition of the young stomach will allow. Instead of linseed-meal they use a great quantity of oat-meal—an article of food much less predisposing to fat and keeping up a vigorous growth. We have in this country a good quality of hay, everywhere a basis of feeding; and after the calf is weaned, or after she has had milk enough to give her a fair introduction into life, hay in the form of hay tea, and afterward of rowen, is undoubtedly the best food the animal can have, especially when aided by a few roots, such as turnips or carrots. In such cases milk is abundant at a very early age, and skimmed milk is advantageously used as a substitute. I should not recommend the use of grain, especially that containing a superabundance of oily matter, as Indian corn and linseed for young dairy stock, or even for dairy cows when in the flush of milk. Perhaps corn-meal sparingly or barley or oat-meal may be used in winter should the animal seem not to thrive well. But a calf that is properly weaned and properly fed after weaning, and furnished with a good pasture, will be carried through the first winter most satisfactorily on good, sweet hay, especially rowen, with roots. In this way can a uniform and well-balanced animal be produced, which, when put to dairy service, will not become coarse and raw-boned in her appearance, nor take on flesh at the expense of the milk-pail.

The business of feeding his herd every farmer must learn for himself, with due regard to thrift and economy. Animals in constantly good condition need less food than those that are not, and of this the farmer must judge, remembering that good shelter in winter is as important as good food. It is poor economy to let a cow get into poor condition either in the spring or autumn. In feeding for the dairy I have found that the best winter feed is good hay, with a supply morning and evening of corn fodder chopped and mixed with fine feed and corn-meal, saturated with hot water, and allowed to stand twelve hours. Prepare the morning feed in the evening, and the evening feed in the morning, always covering carefully the box in which the feed is mixed. I have fed many roots and all varieties, but not with that benefit which I expected except in the health of the cow. Turnips and mangolds impart a flavor to the butter; carrots, which are expensive to cultivate, will only impart color without increasing the quantity. You have been instructed here on the value of ensilage, and I shall be glad to know that it receives the approval of practical and economical farmers, who will undoubtedly continue to examine and judge it. Of the value of oil-meal and cottonseed-meal you are all aware.

I have considered the quality of dairy cows, their structure and capacity for the dairy, and the methods of feeding them as the most essential matter to every dairy farmer. I have said the State of Iowa possesses 854,097 cows. If by proper feeding you can increase the yield of milk one quart to each cow, you will easily add one hundred thousand pounds of butter per year to the present product. Add to this the increased number of cows which your farms could easily feed, and you have an industrial resource here of which your State may be proud, as she now is of the energy and thrift which are rapidly receiving that increase. This calculation is worthy of your consideration. The Eastern manufacturer knows that a very slight increase per hour in the product of his mill, or the saving of but a fraction of a cent per yard on his cloth, will often constitute his profit. So of the farmer. A small addition to each item of a large aggregate of his crops will necessarily yield him a large reward. You will pardon me, therefore, for entering into the mere details of your business as managers of dairy herds. The care of the cream is important, but you must first secure the cream as economically and profitably as possible. The protection of the market against adulteration is all important; but a strong check to fraud is an ample supply of a reliable product. The occupation of the home and foreign market is a matter worthy of your ambition; but we must go first to our cows for our power to supply the market. For the very foundation of this business Iowa has great opportunities. In soil and climate, in pure water and sweet pastures, she is almost unequaled in this land. Together with her sister States in the Northwest, she can reap a great harvest from her herds, and increase largely her prosperous agriculture.

At the conclusion of the president's address the convention adjourned until 2 p. m.

The convention reconvened at 2.20 p. m; Mr. Blount, of Colorado, in the chair.

The PRESIDENT *pro tempore.* Discussion upon the topics presented this morning is now in order.

Mr. FOREMAN, Indian Territory, desired to state why the beef of the Guernsey Island should be considered the choice beef. He asked why the cities of the Eastern States should be the consumer of the inferior class of beef? He had had twenty-five years' experience in handling stock in the West. Poor beef is eaten East, and will continue to be under the present regulations. For instance, you are to ship cattle East. Your herdsman goes out and scours the country and gathers in your cattle that have been there for years. They have never been corraled. They are driven 140 or 150 miles to reach the railroad. Here they are crowded into cars without mercy. The high rates compel the owner to crowd them close. The law says 24 hours to feed. Practice says (and here comes your poor beef) 40 and 60 hours to feed. The speaker had counted 57 dead cattle in a train of 60 cars. Cattle in condition natural to these circumstances is what the East gets for consumption. Best cattle are shipped to Europe. A resolution of the convention, calling attention of the authorities to the law, might be beneficial. Demand that stock shall not be slaughtered before it is dead. He had for years studied the reasons why native cattle were so affected with Texas fever. He found that wherever the cattle are driven to any extent, that, from the fetlock to the knee, will come innumerable small cracks, from which will exude a glutinous substance, and the hair stands right out from it. If the cattle are driven through while the grass is dry no harm will come, but if after the first rain, your cattle are attacked again. He believed if Texas cattle were taken from the grass of Texas, and handled as Northern cattle would be, and not overheated, the native herds through whose country they pass would not be so much affected.

Dr. Loring having resumed the chair,

General JACKSON said: Seeing that the president has come back, I want to touch upon a point or two in his remarkable address, for which I think we owe him a vote of thanks. I want simply to corroborate his views in regard to milch cattle, though we have no dairy and do not sell our milk or butter. We milk about twenty-five cows, principally to supply the negroes on the place. I wish to speak of an old breed of cattle in Tennessee noted for the large quantity of milk they give. It is a cross between the Durham and the Jersey, and gives us the best results as to milk we have ever attained. This cross of the Jersey has the effect of increasing the quantity of the milk without decreasing the quality, and has given us the very best milch cow we ever had. Now we feed the cows on corn, partly, in the winter, and on cotton-seed and a little good clover hay, which, by the way, is the best hay made on the farm, when properly made. It ripens the same time as orchard grass, and when cut at the proper time and properly cured in the sun is very nutritious. Nothing but the best quality of hay is ever used to feed to these milch cows or work stock. We have found by experience that what contributes quite as much to the milking qualities of the cow as anything else is the fact of her having her first calf at a time when she can get the benefit of green grass, which distends the lacteal vessels. It is so with the brood mare. If you permit your cow or your mare to bring forth her first produce under conditions without abundance of green grass you injure her capacity. I doubt whether there is any other thing that will compensate for the grass. She would not be a good milker unless a good nurser. That I conceive to be a very important point.

I regret exceedingly to have to differ with our worthy Commissioner on one point. The Commissioner thought, as I understood him, that the high feed made blooded horses delicate. I differ from him on that point. It is not the high keeping, but the lack of exercise, which produces this effect. Corn-meal or Indian corn should never, in my opinion, be fed either to the young calf or to the old thoroughbred. No food that is heating in its nature should be fed, but a liberal supply of that that is not heating. In the case of a colt that has been well fed, if he has had plenty of exercise, it makes us a valuable animal. So far from the horse thus raised being delicate, they have grown sixteen hands and two inches high, weighing 1,350 pounds. I never preserved the record as to their longevity, but have known it to extend certainly from twenty-eight to thirty-two years.

Strong mares produce the healthiest foals we have, at the age of twenty-four and twenty-five years. I think the best produce we have ever had was from a mare twenty-two years of age. I simply make this statement in order to make a correction of that point, with regard to the delicacy of the thoroughbreds.

These are the only points that I believe I have made a note of on the two addresses—both admirable, and both listened to by me with pleasure and profit.

The PRESIDENT. The convention will allow me to state one or two matters. I have been quite surprised to find that the address I made this morning was attributed to Professor Harris, for the reason that I made some mistake in using his name instead of that of Professor Roberts, to whom I was referring, or rather indicating, that the remarks which I proposed to make had reference to the subject which he had just discussed. I desire to say that this address was my own, so do not charge Professor Harris with any of my eccentricities or opinions. If I had wanted to crawl out myself, I might have done so and left Professor Harris to bear the brunt of General Jackson's strictures. I do not differ with him; I agree exactly with the facts he states regarding the early feeding and working of the colts, as better to be avoided in this country, to give our horses more power; and in what he says about feeding with corn-meal, I agree with him. No man ever saw a good cow made out of an overfed calf. I can point you to one instance with which I am familiar, the horse Ethan Allen. There never was a finer piece of horse-flesh, and his gait was the finest I ever saw. Horses may pull the sulky faster, but the terrific force of machinery when put upon the track at two years old, is, as my driver has said to me many a time, fatal in its effects, and many a colt has been ruined by this business. Feeding calves and colts too heavily does not make good cows nor horses.

General **Jackson.** The practical results are what we want to get at. I quite agree with the Commissioner that excessive food is improper at any time—but excessive feed without exercise is positively ruinous. I have tried to impress the fact that too much flesh is very injurious. I believe you may wean a thoroughbred colt the 1st of November, and keep him locked up until the 1st of May and get him fat as a buck, and you will find his action seriously impaired; I said thoroughbred, because I am more familiar with them. I believe that the best race-horse in the market, if confined from the 1st of November until the 1st of May following, would present such an appearance that you would only have to look at him to tell that he would soon lose his action, and that that horse, under no possible circumstances, could acquire any reputation whatever. I want to emphasise the fact, that it is exercise that is needed and that that is the important feature of providing that every trotting horse, or thoroughbred, shall each have a stall to himself, so that if he does not exercise enough you can reduce his feed, and keep him in good growing condition.

Mr. **Chamberlain** wanted to speak of the paper read by Mr. Roberts. The paper was a success as a burlesque. Possibly as a sober statement of the existing dairy of New York State it may be a success, but as a statement of the dairy cows of Ohio he asked leave to protest; and he thought Colonel Mills, of Elgin, Ills., would protest against it as to the dairy there. When Mr. Roberts says that dairy cows are worth about $15 a head in New York it sounds marvelous to me. I have to state that it would be an exceptional case in Ohio for any cows to be sold at such a price. When he states that the annual income from a cow amounts to $26 a head, I will say to him that he cannot find that to be the case in Ohio. When he mentions $20 or $30 as the cost of building per head, I do not understand how he harmonizes that with the northwest corner of a rail fence. When he got 150 pounds of butter as a cow's yield, and also stated that the value of a calf was but $1, I wanted to inquire whether any cheese was made in addition to the butter, or, if not, what was done with the skimmed milk, and if fed to the pigs, what became of the pork; if fed to the calf, why should not that be counted as a part of the proceeds? As to his argument in favor of the better breeding of dairy cows I agree with him, and I am glad to inform the professor that that work is already begun in Ohio, and he can find there cows the income from which is $26 or $32, but he will have to give $50 for them at least.

Mr. **Smith.** Will the gentleman say what number of cows was in the dairy he selected as an illustration, and what the product of that dairy is, and then divide it so that the product of one cow may be determined?

Mr. **Chamberlain.** I know it is asserted that figures do not lie, but I must confess that in my opinion there is nothing that lie worse. In Ohio the farmers are compelled to give to the assessor the number of cattle they own, and they must swear to the correctness of the statement. If I have twenty-five cows and put in twenty, my neighbor reports it; knowing this we are pretty careful, and by this means we get a pretty accurate account of the number of cattle. When the tax-assessor makes up his list of personal property the number of these cows is given, but when he has ascertained this he starts out forgetting to ask how much butter they make; so that there is no accurate information showing the quantity of butter made in the State, and there is no method of determining the quantity that is produced.

Mr. J. M. SMITH. Can you gentlemen give me the net proceeds of a cow, or of a dairy of cows, where the entire product of the milk is delivered to the factories?

Mr. CHAMBERLAIN. I want to finish what I was saying about our dairy in Ohio. I cannot give any detailed statistics showing these points for my own county, but I will state that S. Strait & Son produced more than double the amount per cow of product stated by Professor Roberts.

Dr. LORING. What is the average price of butter per pound in Ohio?

Mr. CHAMBERLAIN. The average price of S. Strait & Son was 28 cents, and cheese about 10 cents per pound.

Dr. LORING. I want the market price.

Mr. CHAMBERLAIN. It was 25 cents.

Dr. LORING. What is the price of milk?

Mr. CHAMBERLAIN. About one cent per pound for factory milk.

Dr. LORING. Is that all?

Mr. CHAMBERLAIN. That is all, where they sell the milk to the factories.

Dr. LORING. They carry it to cities to sell sometimes, do they not?

Mr. CHAMBERLAIN. Yes; for the wholesale product; the retailer is paid about six cents per quart.

I was going to say that S. Strait & Son produced double the amount that was credited to the entire county by the reports. I have noticed repeatedly that the figures are entirely below what is correct. That proves conclusively how unreliable the statement we have just heard must be, since it is founded on those reports. And hence the fallacy of these figures. Not half the product of these counties is given. The number of cows is correctly given, but the product is not half given, and this is one of the causes of the injustice done to our dairy. The average per cow from the books of Strait & Son for a whole season—the gross receipts—were $50 per cow for the whole factory, and that is exclusive of the winter butter and cheese made at the farmers' homes. Now, I will read what Byron Hawkes says:

> Began eight years ago with cows that made less than $30 apiece at the factory, and by crossing with pure Durham bulls, from known milk stock, the dairy this year, 1880 (consisting of ten grade Durhams), milked, in eight months, with nothing but grass to eat in the summer, 16,462 pounds, an average of 1,646¼ pounds per cow, and the calves sold for $7 each at time of birth. The cows have made in eight months, counting the calves, a little over $85 each. The milk was sent to the factory of M. Goss & Co., of Rochester, Lorain county, Ohio. The dividend of the factory was a little over $1 a hundred.

This is an example of what the dairy industry amounts to in the West.

Mr. BROWN, of Indiana, said: Twenty years ago they began in this State with scrub cattle. First Devons, then short-horns, and recently Ayrshires were introduced. Indiana has, within the last decade, increased her milk stock over 40 per cent. He concurred with Professor Roberts's physiological deductions. One thing must not be lost sight of. These are creatures of habit. It will, of course, add to the vital force of the cow to give it four months of rest from milking, but you are establishing the habit of being dry four months that will be transmitted to the offspring. It is important for those who want milk to avoid this. It can be done by giving richer food, and extending the nutrition in order to maintain the vital force against the drain of the milk.

The **President**. Whoever wrote the essay which I delivered this morning [laughter] took especial pains to get the best and most reliable figures in this country. The doors of the Census Office were open to him to go in and take all he could find, and he did so. Now, I stated that of butter there was in Ohio 100,533,754 pounds, valued at $25,133,434; cheese, 24,507,144 pounds, valued at $2,450,714; milk, 49,550,608 pounds, valued at $4,955,068; total, $32,559,266.

This makes $41 per cow. Now, in addition to this, there is a very large amount of milk yield in the large towns. In Massachusetts it is an immense trade, and it must be in Ohio. I think it would be safe to say that the average of each cow in Ohio is $50. Then, I think we ought to estimate the calf as worth a little more than $1. I get $2 for mine. Now, gentlemen, let us go still further, and estimate the manure, for its value ought certainly to be taken into consideration. But even at $50 each it is a good investment on the money.

Mr. **Brown**. May I inquire whether that includes the domestic consumption in the farmer's own family?

The **President**. I have no doubt that the real product of Ohio is considerable, and it should be estimated also.

Mr. **Chamberlain** thanked the president for the figures. He thought there should also be added the calves that are raised for dairy purposes, and for beef, therefore, $50 would not begin to touch it.

Professor **Roberts** had left many facts open, hoping to call out discussion rather than to treat the subject exhaustively. There were a dozen subjects in the paper, upon each of which a book could be written. Mr. Brown had misunderstood him relative to the perpetuation and development of milk qualities. He thought the animal should be made to produce all that she could, consistent with health and vigor, until her habits were formed and could not be changed, and then he would modify her life a little to provide for the offspring. In returning from a dairyman's convention in New York two years ago, a factory man who manufactured the products of 800 cows told the speaker that many of his patrons did not average over $24 per cow. He had divided the cows into three distinct classes—one that causes a loss of money, one that vibrates between gain and loss, and one that makes all the money there is. What he recommended was to cut off the heads of those that run the farm into debt. In sections of New York he could buy for $15 a head, and they could be found in Ohio, Illinois, Iowa, and all over. He had put them at $32.50, and next spring he could buy 10,000 calves at $1 per head. He wanted to show that in New York there are 500,000 cows running the farmers into debt, and 500,000 out of which money is being made. In regard to the manure, Professor Roberts considered the manure of a cow, if properly fed, worth $25 per year.

Mr. **Chamberlain**. I desire to ask you whether you think the statement you made about New York is a fair average? Were there not as many cows not in the dairy owned by small farmers—five, six, and seven in number—and is not the amount earned by these cows as large as the amount earned by the dairies?

Mr. **Roberts**. There is, of course, much milk produced in that way. I do not know how it compares in quantity to that sold to the factories.

Mr. **Chamberlain**. Do you think you could buy those cows for twenty-five dollars?

Mr. **Roberts**. I could get some at twenty-five dollars.

Mr. CHAMBERLAIN. I know of friends of mine there, who keep from seven to ten cows, on their farms, and consider them worth seventy-five dollars; of course, every cow will not average as high as that. The number of cows in the dairies does not give the right average for the whole State. I think that is where the difficulty and the trouble is. I have no way of getting at these facts, other than by statistics, and by the books of the dairy-men. When I get at the books of a dairy-man, I get some figures exceptionally large, and some exceptionally small. In the first case, the production of the sixteen thousand pounds of milk from one cow, and in the second place a gross product of only twenty-five dollars for each cow.

Mr. COBB said: A good many keep but one cow. The product of that cow is half of their living. A friend in Illinois, for instance, had sold $125 worth of milk from a cow in one year. We do not get at all the facts from the dairy statement as now made. The cows supply the people of the country with a large part of their living.

Mr. HUBELL. Will the gentleman state what breed the cow belonged to which produced 16,000 pounds of milk in a year, which makes 50 pounds of milk in a day for three hundred days, a circumstance so abnormal as to be difficult of belief, and certainly affording no basis on which to build up a theory for practical guidance. We should not select extreme cases, but rather average conditions, as the basis for our selection of modes of procedure.

Mr. ROBERTS. I wish to read a brief extract, from an essay on the dairy, written by Hon. X. A. Willard, of Little Falls, New York:

> I know that there are many dairy-men in the Eastern and Middle States who complain that no money has been made in dairying at last summer's prices, and they doubtless speak the truth from the standpoint of their own experience, but I cannot believe that it is necessarily so. It is a humiliating thing to acknowledge, and yet it is a fact susceptible of proof, that the mass of dairy-men have not improved the milking qualities of their herds during a long period of high prices, but, on the other hand, they have allowed their herds to depreciate in value by using refuse cattle from droves, rather than in breeding stock on the farms. When cheese brings from 15 to 20 cents per pound, and butter from 40 to 50 cents, cows that yield 300 pounds of cheese, or 100 pounds of butter per year, are supposed to turn out some profit, but when prices fall to this year's rate it is found that these inferior herds do not pay expenses.

Mr. COBB, of Illinois, and Mr. Aiken, of South Carolina, discussed the viciousness of Jersey bulls. Mr. Aiken explained some of the qualities of the Brahma cattle. He finds them very valuable, but they can't be confined. They hardly have their equals in milkers—one cow giving 32 quarts per day.

The committee appointed to wait upon Senator Morrill, with reference to certain features of his educational bill, made their report. A spirited debate followed, which, by resolution passed on Saturday, January 14, was ordered expunged from the records.

The resolutions were laid upon the table.

The PRESIDENT. There remains to be presented a sketch of the Signal Bureau work for the agriculturist, and an essay upon the more perfect organization of the agricultural interests, by Dr. R. T. Brown. The chair reminds the convention that to-morrow commences the convention on cereals, and this question of Signal Bureau work really involves so much the question of crops, that I think it would be wise to have that paper during the series devoted to that subject.

Mr. Jackson coincided with the president's views, and spoke of the vast importance of the service to agriculture.

The PRESIDENT. Then the first essay to-morrow will be Mr. Birkheimer's paper, to be followed by essays on the "Improvement of cereals," "National and International crop reports," "Inspecting and grading of cereals." [After a conversation with Mr. Blount.] At the request of Professor Blount, his essay will be first in order to-morrow morning.

The convention then, at 4.48 p. m., adjourned.

SATURDAY MORNING, *January* 14, 1882.

The convention was called to order at 10.40 o'clock.

Mr. **FERNALD**, of Maine. Mr. President, inasmuch as the resolutions presented near the close of our session yesterday afternoon gave rise to a little discussion which was regarded as slightly of a political character, and in order that the records may be entirely free from anything that has even the suspicion of a discussion of such a nature, I desire to move that the resolutions and the discussion which ensued be omitted from the records.

The motion of Mr. Fernald was adopted.

Mr. **CONNOR**. I wish to offer this resolution:

That it is the sense of this convention that the revenues arising from the sale of the public lands should be appropriated to the institutions established by the donations of the government.

In making that motion, Mr. President, I desire to say that these various institutions have their base upon that kind of public policy, but I cannot see what objection could arise to the further sale of the public lands, the proceeds to be appropriated to the further endowment of the institutions which have been established upon this line of policy.

The **PRESIDENT**. The chair will state that the resolution, with the whole subject, was carried to the table and lies there. The first motion, therefore, in order to raise it, would be to take it up from the table.

Mr. **CONNOR**. Then, Mr. President, I make that motion.

The motion was not agreed to.

The **PRESIDENT**. The first paper before the convention will be that on the "Improvement of cereals," by Mr. Blount, of Colorado.

Mr. **BLOUNT**. What I have to offer this morning by way of the improvement of the cereals, will be, perhaps severely practical, not theoretical, from the fact that all my dealings with them, and with the seeds thereof, have been practical and not theoretical. I have attempted to put the most grain on a single stalk of wheat, and I have attempted to lengthen the heads and improve its elements in two ways—make the straw stiffer, adapting it to different climates and soils and different modes of cultivation. I have attempted to improve the grain in the wheat as well as corn, and what I wish to say to-day will be in that line entirely. I have disregarded fertilizers from my experiments, from the fact that I wished to test the virgin soil, soil of one and two years old, and so on.

The rules I observed in this experiment were identical with those observed by the stock breeders, with two exceptions; one is the crossing must be artificial in crossing the cereals. In the stock department they do it naturally. I will not mention one-fourth or a hundredth part of what might be mentioned here with profit, in the province of the paper I read.

IMPROVEMENT OF THE CEREALS.

By Mr. Blount, of Colorado.

At the present day the cereals, under the common mode of cultivation, yield only about seven-sixteenths of their real capacity within the cereal belt of our country. Were the whole area of the United States included, the maximum yield would stand at a much lower figure.

Wheat, oats, corn, barley, rye, and rice constitute our cereals.

Corn and oats are not particular where they are planted; they will grow and try to make something. They are really indigenous to every State; in fact, they flourish in all their beauty, luxuriance, and usefulness anywhere between tide-water and snow-line.

Wheat, barley, rye, and rice are much more eccentric in their habits, preferring certain soils and climates to develop their essential properties for man and beast. * * * The Great American Desert, which includes the agricultural portions of Colorado, is fast becoming the leading section, especially for wheat, oats, barley, and most of the vegetables. To raise these costs much less than elsewhere, the crop being much surer and the yield greater.

In the first place, up to this time, no fertilizers whatever have been used, the character of the soil and water being such as to preclude the necessity of this expense. Secondly, no loss is sustained from the effects of drought, the system of irrigation being so perfected that every crop of the wakeful farmer receives its due amount of moisture. The expense incurred by irrigation does not amount on an average to more than 50 to 500 per cent. of the losses sustained from drought and wet. The expense of preparing the soil, sowing, cultivation, and harvesting is less by 150 to 200 per cent. than in wooded sections. The yield, too, is much greater.

So far as their adaptation to soil and climate is concerned, as well as to the wants of man, corn heads the list. It possesses all the properties of the others, and more—it has an abundance of oil and the power to resist all its enemies.

Wheat is full of eccentricities, made up of whims and freaks. In some sections it promises one day to make the farmer a millionaire; the next, these promises are all blasted by blasted heads and rusty blades. In money value, wheat is king; indeed, of so great value is it that corners are built upon it here and there, and large supplies are exported to the remotest ends of the world.

Corn is general and universal, reaching in its uses and provisions farther than all the rest.

Every man can raise corn, but every man cannot raise wheat. Now, it is a fact we all recognize that half a crop is not made in the cultivation of the cereals the country over. Why ? Every one can give a reason. It is the object of this lecture to give mine in a few practical remarks.

Records and well-authenticated reports show that 102 bushels of wheat, sown broadcast, have been produced per acre (I. S. Ray, Montana); that 108 bushels by special culture (F. F. Hallet, England); that 791 pounds from one pound of seed (A. I. Scoggins); that 1,800 pounds from one sown (A. E. Blount); and that 576,840 grains, per 47 pounds and 7 ounces, have been produced from one grain, by division, resetting, and cultivation (C. Miller, Cambridge).

Records also show that 296 bushels of shelled corn have been raised on one acre (C. J. Cox, Selma, Alabama); that 64 ounces have been produced from one kernel (Compton); that 3 bushels and 9 pounds from 100 stalks (A. E. Blount); that 63¼ ounces on one single stalk (A. E. Blount). Now, if, with a little science and extra culture, the capacity of wheat and corn can be strained up to these figures, is there not room for doubling the averages by the ordinary method of cultivation ?

It is hardly necessary to say that there is ample room. It is one of the strangest things to my mind why this gaping chasm has not long ago been bridged. In the first place I shall attempt to show where the first abutment should be put in, taking wheat to begin with. Seed wheat as generally used now-a-days is hardly fit for chicken feed, say nothing of using it for seed. It is degenerate, impure, imperfect, full of parasitic *fungi* and simply ruinous to the farmer and to our health.

Up to this date there are in the United States over 350 different varieties of spring and winter wheats; among all these that have become standards are found typical and genuine grain, true to name—which any farmer with an eye to improvement and profit must see in his ripening crop. This genuine grain, which is always found in the largest stools—those that come up evenly together and ripen uniformly, he should select and pick *himself* and sow on choice land, cultivate, harvest, and put away under lock and key to be again sown, cultivated, and harvested by *himself*, that no meddling can interfere and no mixing can take place. * * *

> "He who by the plow would thrive,
> Himself must either hold or drive."

This is the first abutment I would put in the bridge, the first step toward per a wheat by the pedigree system, the same system adopted by F. F. Hallet an other intelligent and successful wheat growers of our own country.

By following the rules by which it is successfully carried out and observing t ural laws that govern vegetable growth wheat can be made to double the le the head, increase the grain 100 per cent., its powers as much, and its quality so greatly improved that one will hardly recognize it as being the same kin three years' improvement.

To breed up a wheat (if I may use the expression) to a degree that will dev full power is a work almost any observing farmer can carry out. It is not a la task but one of persistent effort, and therefore one of great profit.

In carrying out this system in the improvement of wheats, I adopt nearly th rules and laws that govern stock-men in breeding in-and-in. The pedigree syste not in any way create new varieties; it only improves, making two blades, as two grains, grow where but a poor individual grew before.

The system of cross-breeding is by far the better of the two, from the fact that can be made to suit any soil and climate as well as to contain any or all the el essential to success in the field and in the mill. The operation of crossing one upon another is comparatively easy. But the work to be done before and afte ing requires much tact and calls into requisition all one knows of vegetable phy and the art of combining elements.

One must be well acquainted with the character, habits, elements, and stre the two varieties to be crossed before breeding in order to know what proper develop and what habits to discard. He must know the strength of the femal her power to reject the enemies that infest wheat, and he must know the qua the male as to the grain. After the cross has been effected the same knowl necessary, but it must be exercised with greater force and discrimination an severer tests, that the offspring containing the better qualities may be nourish the worthless rejected. In the operation of crossing there does not appear to b science; anybody can cross two wheats, and may succeed in producing a prett variety once in one thousand trials; in some respects he may obtain the qualit sired, but it will be an accident.

The effects of crossing wheats are wonderful; sometimes so wonderfully disa ing that the experimenter is astonished at the outcroppings. For instance, a wheat is crossed upon a bearded, or *vice versa*. The experimenter is in a qu when he beholds the result to know whether he or nature could have been at f bringing out such a mingled mass of ingredients. As the heads begin to issu the sheaves he is dismayed at the irregularity, the appearance of such a diver forms. There are heads of various lengths and various shapes—some bearded an smooth, some half around and some half smooth, some like both parents and so neither. The straw, and leaves, and chaff, too, are completely transformed, pos the characteristics of both parents, besides some elements more likely to have be to the dark ages. The grain as well undergoes changes least thought of. The to have been jostled together in complete confusion, struggling to see which, the or lower, characteristics shall get the ascendency. In the midst of this combi of forces reversion plays a very active part. The tendency backward is greate the tendency forward.

The offspring being now in his hand, the experimenter is again compelled to science to his aid in selection. All grain possessed of bad and undesirable q is rejected, and the good is sifted and tested again and again. Tests are appl starch and other elements to obtain its status as a milling wheat. The farm must be satisfied. He must raise it under different circumstances, in differen in different climates, for ten years before he can tell whether or not it is a pro kind for him to raise.

This medley of circumstances taxes the sharpest eye and calls to the work ch skill that we may know with what properties we are dealing.

On account of the difficulties attending all this work the crossing has been by some hybridization—a misnomer.

Improvement of wheat in this line is attended with much patience, care, an After the offspring have been brought out they are subjected to much severe All having no fixed color or form are rejected, and those having the desired cha istics and qualities are again tested, &c. Sometimes an experiment can be sati three years by the wheat becoming "fixed;" sometimes it takes four and ev years to combine all the properties in their proper proportions. My note book the fact that some varieties will easily cross one upon another, but will no another upon one. For instance, foreign wheats cross readily upon ours, but o to effect a cross upon them.

I am aware that many theoretical writers—and among them I find one or two ists—are of the opinion that new varieties of those cereals—called hermaphrodit be made by selection. James S. Lippincott, of New York, in an extended art the geography of plants (Agricultural Report 1863, 464), takes that ground also. Lindley, Klippart, Manud, and Raynbird, entertain the same opinion. I cannot conceive of a new variety being produced within itself any more than in-and-in breeding produces a new race. As I have stated before, selection improves but never produces.

In making new wheats by crossing, I will state again a strong female should be selected as to stalk and blade, and as to the grain, a strong male. In other words, the female should have strong, stiff straw, well glazed, and good milling properties, and the male should be possessed of the same qualifications, with a grain that has at least 12 to 14 per cent. gluten. Now, in all this work, especially in that pertaining to the improvement of wheat by the pedigree system, there is one serious drawback, not noticeable alone in the cereals, but in all improved vegetables and seeds. Every advance forward in line of improvement opens the door to a ruinous deterioration—that is, when highly improved grain is put into the hands of the common farmer, who never cares from what source his seed comes, how it is saved, or of what kind it is, retrogression is certain. Neglect and bad management at that crib, as well as at the stock-pen, always stand prominent. The most highly improved and finest grain has a tendency to revert to the original—yes, and back still further will it decline if a single loophole is left open. * * * Both Von Krous and Knight believed in the degeneracy of plants. The former believed they tended to revert to their original state, while Knight believed in absolute decay. Knight believed that plants would cease by a natural statute of limitation. Von Krous believed they only fell from grace.

In the system of cross-breeding this is not the case, or at least deterioration is not so rapid and ruinous. Crosses, or hybrids as they are called, when once fixed, retain their powers and good qualities many years, even when badly handled. Hundreds of English wheat growers condemned Hallett's pedigree wheat because they said "That while he doubled the yield, the grain was proportionably coarser, and the flour inferior."

In our own country this may give rise to the question whether it is better to strive to double our crops with the prospect of making them coarser staring us in the face, or content ourselves with the trifling average now reported. For one, I am by no means satisfied with small yields and poor quality. When I cross wheats or corn, I always intend to take all the bearings beforehand, in order that the acre that produces 40 bushels will yield as good quality as the acre that makes 5. * * *

Inasmuch as a great work is left in the natural world for man to do, I intend in all my experiments to make art outmaster nature in this line.

It is the same in the vegetable kingdom as in the animal—the poorer and coarser the individual, the more prolific when neglected and permitted to revert or run wild. For instance, when the Australian wheat was introduced into Colorado, it produced well and made most excellent flour. Now, it produces more and the flour is third or fourth grade, the gluten having decreased to but 7 per cent. On the other hand the hybrid standards are, in the hands of skillful farmers, producing 30 to 60 bushels per acre of the finest of grain for field and mill.

You will now ask what is obtained by all this labor. I answer, much! Please examine and test the flour of to-day made from the hard wheats like the Fife Defiance, Russian, Mexican, Pringle's and Arnold's Hybrids, Oregon Club, and others, and the flour of the old Mediterranean, Diehl, Gennesee, and others of 1850, and I can assure you that where skillful and scientific hands have had the management of the standards the flour is 100 to 500 per cent. better, and the wheats as much in all respects.

One word more about wheat. Enough wheat is wasted in thick-seeding to supply the whole wheat-growing population the year round. Repeated experiments in Europe and in our own country have proved beyond a doubt that every pound of wheat sown can be made to produce a bushel—in other words, that 30 pounds the country over is enough seed for any acre, if put in properly and sown at the right time. I am aware that there are many opposed to thin seeding, nevertheless the physiological make-up of the wheat-plant, its nature and habits plainly show that it must have room to develop its powers (the greatest enemy to wheat is wheat), hence in all cases under favorable circumstances, thin seeding has never failed to produce greater returns than thick. So far as the cultivation of wheat is concerned, my experience shows that on an average one cultivation will produce enough more grain to pay for the extra labor twice over.

Of corn but a few remarks by way of improvement. Professor Beal, in his admirable lecture on Indian corn, has covered the whole ground of its history, utility, and culture. In addition, I would mention a few items of interest.

Wheat, as I have already stated, is hermaphrodite or bisexual, having both stamens and pistils in the same flower and on the plant, while corn is monœcious, having the stamens in one flower (tassel) and the pistils in another (silk), both on the same plant. Exposed as these generative organs are, the plant flowers easily and is fertilized by the agency of insects, wind, and force of gravity. In wheat, mechanical means have to be used to produce a cross, but in corn mechanical means have to be used to prevent crossing.

The ease with which all corn mixes has produced varieties without number, in fact it may be said there are none pure, none genuine, none true to name. There is no limit to the changes that can be made upon corn.

By selection, as in wheat, the stalks can be made shorter or taller and more uniform, the blade more symmetrical and regular, the shanks less objectionable and more limited, the husk wider and longer, the cob smaller and stiffer, the grain more regular and uniform, and the habits of the corn much better in adapting itself to soils and localities.

By crossing one upon another kind the color, texture, form, quality, and the whole individual can be changed by the experimenter. For instance, should a mongrel be wanted four kernels of different varieties can be planted near together, one kernel white dent, one yellow dent, one kernel pop-corn, and one sugar. Should all these four kinds tassel and silk at the same time, each would be fertilized by the pollen of its three neighbors, but not by its own, making thereby the offspring a mixture in proportion to the amount and strength of pollen received from the other three. On neither kind would there be found a single kernel exactly like either of the four planted, from the fact that corn does not generally fertilize itself. No one variety can be made to suit all localities on account of its habits. The farther north corn is raised the shorter the stalk and the more flinty the grain; while the further south the taller the corn and the softer the grain. Should these two extremes be united the means would include New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Missouri, Iowa, and so on to the east line of the Great American Desert. This belt constitutes the section in which corn can be raised to the best advantage, at the least cost, and at the greatest profit. Corn can be improved in many ways. First, by making use of seed properly selected.

All seed-corn should be selected in the field, because there and there only is it possible to obtain the seed true to name, and possessed of the desired characteristics. Only in the field can perfected ears and perfected stalks be found together. Seed-corn should be taken from different parts of the field, to make the relation as remote as possible. Seed-corn should be picked from those stalks that bear the greatest number of ears, to make it more prolific.

Seed-corn should always be selected from the top ear of those stalks that bear the largest number, because on the top ear is always found the genuine typical grain, the other ears below not having developed sufficiently to produce good seed on account of an insufficient amount of pollen. Seed-corn should always be saved from those stalks that ripen earliest, to make the season of its maturity as short as possible.

Seed-corn should be taken from well-formed ears, tapering uniformly, with straight rows, because they are more easily and better protected by the husk, and bear more grain in regular than in irregular and crooked rows. In breeding corn in-and-in every ear designed for the propagation of the species intact, should be protected by a covering of thin muslin before the silk appears, to keep insects and the pollen of foreign and barren stalks away.

The difference in planting corn selected in this manner, and that taken from the crib, is wonderful and wide. A hundred per cent. in favor of the selected seed has been reported in hundreds of cases, prominent among which are the experiments of E. S. Carum, of the Rural New Yorker, Dr. Sturtevant, of Massachusetts, and others.

In every cornfield is found an enemy too little noticed by almost all farmers. It comes in the shape of corn itself; is ruinous and baneful in the extreme. This enemy is seen in all parts of the crop in the shape of thrifty stalks without ears—barren stalks, they are called.

The pollen, which is very abundant, degrades every ear it fertilizes. Being so abundant it is distributed far and wide, and its deteriorating effects are plainly seen year after year more and more. The careful and vigilant husbandman is aware of the deleterious effects of these intruders, and at an early stage cuts them away.

Oats, barley, rye, and rice claim none of our attention at this time. Oats, barley, and rye grow so easily, so naturally in most sections, and are so prolific, that time spent on improving them may not be so well spent as upon the more valuable and finer cereals. In Colorado 70 to 90 bushels of oats are frequently raised per acre, and what is better, they weigh 40 to 50 pounds per bushel. In the Rocky Mountains, just above us, rye grows wild. Two rows barley produces from 40 to 50 bushels per acre, and is so little in demand that attention given to its improvement, we think, is wasted.

Upland rice received from Japan is now being raised successfully in many sections, and will pay, I think, in some localities.

Much more might be said upon cross-breeding and hybridizing, but they are not within the province of this essay.

The Chairman *pro tempore*, Mr. BLOUNT. The next essay that will be read is No. 4, which the chairman has directed to be read in the place of No. 2. The subject is the better organization of the agricultural work, and the essay will be read by R. T. Brown, of Indiana.

THE ORGANIZATION OF AGRICULTURE.

By R. T. Brown, of Indiana.

Though the people of the United States represent nearly all the varied forms of productive industry, yet agriculture engages the largest part of our labor, employs the greatest amount of our capital, and is the great fountain of supply for our wealth, whether individual or national. Commerce and trade may accumulate wealth, but farming, manufacturing, and mining alone can create value. But agricultural capital is widely diffused, and its production is distributed among millions of producers, each contributing his imperceptible rivulet, so that as a financial force it produces scarcely a perceptible effect on our State or national legislation.

The rain drop that falls from the cloud is scarcely felt when it strikes the earth, yet these combine themselves into a mighty river, and rushing down the precipice of Niagara, its force simulates Omnipotence. In a popular government like ours, if the agricultural interest and capital of the country could be so concentrated as to act as an unit, it could easily control and direct legislation, and mold the destiny of this great American republic. Yet I would not advocate, nor do I believe the farming interest requires such a patronage from the general or State governments as would promote the prosperity of agriculture to the injury of any of the great sisterhood of industries. But it is a duty we owe to farming as the business that feeds and clothes the millions and the monarchs, that we so unify its widely scattered interests as to make its powers felt, at least so far as to secure its protection from the encroachment of what would seem to be the conflicting interests of other industries, and to secure a fair share of whatever the government may legitimately do to advance the interest and promote the prosperity of her citizens. To secure this end, agriculture, as the leading industry of this nation must be organized. But what the wise fathers of the republic saw in regard to civil government, we can more distinctly see in regard to agricultural organization. The national organization must be a complex unit. The British island may represent the agricultural interests of that people in a Royal Agricultural Society, and France may gather the farming interests of that republic around a Grand Agronimic Institute at Versailles, but this nation which bids fair, at no distant day, to number a hundred populous States, largely devoted to agriculture. must, in its central organization, represent States rather than individuals. Our agricultural organization, though loosely held together by a feeble bond, has proceeded on a correct principle. In most of the States we have county or district societies, each with its president, secretary, treasurer, and board of directors; and of these suborganizations are formed State boards with their proper officers and machinery; but here the organic force appears to have exhausted itself. At the other extremity the general government has begun the work of organization by creating this department of Agriculture with its several divisions, and furnishing these with a fair outfit in the way of library, cabinets, and apparatus; and in addition to this department, Congress has, quite liberally endowed a polytechnic school in each of the States, where agriculture, mechanics, and military science shall be taught.

Now in the State boards, the agricultural school, and this department we have the elements out of which may and should be constructed a complete and efficient organization of the great agricultural forces of this nation, and such an one as would accommodate itself to the indefinite growth of our population, and development of our agricultural resources. We have thus the material prepared, and the time has fully come when we should proceed to the construction of a grand industrial edifice in which the prominent feature should be the productions of the soil. But I shall not attempt to photograph that magnificent structure; sufficient at present to say that such a relation should be established and maintained between the State boards of agriculture, the State agricultural colleges, and this national Department of Agriculture as will result in a division of labor, so that one in ignorance of what the other has done, or is doing, shall not repeat the same work. Agriculture is peculiarly an experimental science, and the art is yet largely tentative.

A few principles are well established as to the cultivation of the several crops, and the treatment of different soils; beyond these lies a vast territory that has yet to be explored by careful experiments.

To this work of evolving principles and laws by experiment, it is not a very industrious and successful farmer who is adapted, and if he were, he cannot afford to devote his time to this work, in which every other farmer has an equal interest with himself, and in which all should bear an equal share of the burden. This is pre-eminently the work of the experimental farms generally attached to the agricultural schools. First, because these are, or should be, controlled by men qualified for conducting experiments, observing results, and deducing conclusions from them; and second, in this labor he will be instructing his pupils in the important work of experimenting. But in this work there should be concert of action, and to this end there must be consultation and assignment of labor to each agricultural professor. Let this be accomplished by a meeting of all the operators in this line, and a general agreement as to what is to be done, and who is to do it, with regard to the whole field of experimental work. When the work is done, let the results be tabulated and reported to the respective State boards. This information, added to that gained from the county and district reports, and that collected at the annual fair, should be transmitted to this department, where the whole should be carefully digested, and the essential facts established by the several State reports, together with what the department may have gleaned from foreign correspondence, should be published in one or more volumes and distributed through the State and county organs to the individual farmer for whose use they were made.

But the prominent defect in our present organization, if such it may be called, is the want of a proper coherence and concert of action between its several parts. At present the Department of Agriculture, which Congress wisely designed to be the head of a great national organization of agricultural industries, is completely severed from the working members of the body of which it was designed to be the directing organ and great sympathizing center. The county and State boards of agriculture know but little more of the doings of this department than they do of the edicts of the Emperor of China, and it is but fair to say that the ignorance and want of sympathy is mutual. Men prominent in the State organizations hardly know there is such a body as the Department of Agriculture. A stray volume of its annual reports which some candidate for re-election to Congress has sent to his bucolic friend to secure his influence, or an occasional sneer at the department in his political paper, are his only sources of information; and the Commissioner has scarcely any better opportunities to know of the doings of the State boards and agricultural colleges. In this state of non-relation, if not alienation and antagonism between these elements of a common interest, there can be no concert of action nor recognition of mutual dependence.

In organizing this central department, Congress failed to comprehend the vast extent of our country and the immense magnitude of the agricultural interests. To fill the Congressional ideal of his duties the Commissioner should, like the fabled Argus, have a hundred eyes, and like Briareus, a hundred hands; or to speak without a figure, he should be in intimate relations with all the agricultural interests and forces throughout the whole nation. Personally, this is impossible; but Congress should provide for a deputy commissioner in each State, who should be the connecting link between the State and national organizations; through him the department would be advised of the movements, the success, and the failures of the State organizations, and through him the State boards would learn, not only what was being done here in the way of introducing exotics and acclimating them, but as well what was done in all the other State boards and on the State experimental farms, and at the various experimental stations in Europe. This deputy should attend all the meetings of the State board and of the executive committee, and should be present at the State fair, noting every mark of progress, and every defect as well; and should faithfully report all that he sees and learns to this department, that through it the information may be transmitted to all the other State societies. He should be in intimate relation with the agricultural college, and should frequently visit its halls and its experimental fields, and from time to time report his observations to his principal; in short, he should industriously give his whole time to the duties of his station, and should be compensated accordingly. I am aware of the objection that will be urged against completing our agricultural organization on account of the expense it will involve.

To foster and encourage the productive arm of this nation—the arm that feeds its millions and fills its coffers—will not require more than ten per cent. of the annual appropriation we make to pay the Army, which, at most, only guards our interests, often against an imaginary danger. The magnitude of the farming interests in this nation, and the ridiculous pittance annually appropriated to advance that interest, is among the absurdities of these times that posterity will wonder at.

As has been already hinted, a more perfect division of labor, both of production and of marketing the products of the farm, will be one of the beneficial results of organizing our agriculture. This will cover not only the experimental department, embracing the best mode of culture, kind of crop, variety of seed, time and method of planting, best implements for cultivating and saving the crop, but it will also involve the question of farm statistics and the best mode of collecting and digesting these, so as to make them of value to every farmer. The subject of transportation as collateral to the profits of farming will also demand a share of attention. Each of these must be assigned to its appropriate agency that every one may know his proper sphere of work. Now, in our disorganization, each local society, to some extent, is attempting this whole range of duty, with the result of but little progress.

The subject of collecting crop statistics is one that has elicited a lively interest and called out much animated discussion. Indiana has attempted a solution of this problem by State authority, with the prospect of satisfactory results. It is proper to say that crop reports at best can be but approximations toward the truth, but these affect prices materially when published. Grain dealers have been accused of manipulating statistics, and sometimes fabricating them, so as to greatly exaggerate the crops and reduce prices in first hands. On the other side, farmers' clubs and agricultural societies have undertaken the difficult task of fixing the size of an unmarketed crop. And now, as might have been anticipated, it is hinted that farmers have an interest in underestimating the crop; and therefore, the legislature of Indiana, proceeding on the maxim that

> "All mankind are very weak
> And little to be trusted,
> Itself the wav'ring balance shake,
> It's rarely right adjusted,"

made it the duty of the township trustees, under oath, to collect and report the crop and other statistics to a disinterested bureau, where they shall be tabulated and published by State authority. Thus far our experiment has worked well, and if we succeed in keeping our bureau of statistics out of the hands of speculators we will be able to present as reliable statistics of farm products as the nature of the case will admit of, and in doing so we will point the way to relieve the agricultural organization from a difficult task and a grave responsibility.

On the whole premises the outlook is hopeful. Agriculture as an art is old; as a science it is but an infant, and if we succeed in our effort to place the art under the guidance of science we will greatly diminish the drudgery of the farm and vastly augment its productiveness.

THE PRESIDENT. I have received a communication from the acting commissioner of the Choctaws, Chickasaws, Cherokees, Creeks, and Seminoles—the Five Nations—asking for seeds from the department. It has suggested to me that General Porter could give us some interesting statistics upon the cereal capacity of the Indian Territory. Therefore an invitation has been extended to General Porter, and I have the pleasure to announce that he will present such a paper at 2 o'clock on Monday. I have had a request from some of the delegates present, to confer with the representatives of the railroads in regard to procuring a reduction of the return rates for the members of this convention. I have been unable to make any arrangement of that character, on account of the great number of routes. The fact that there are not enough delegates going on any one road, prevents the securing of such a reduction. I think if such a request had been made before the assembling of the convention it might have been done.

Professor INGERSOLL. Inasmuch as several present may like to hear the report of the Signal Office with regard to agriculture, and as I am much interested in meteorological work, having seen for myself what they were trying to do for the benefit of agriculture, I should like to hear the essay on that subject. I therefore move that this essay be now read.

The motion was agreed to, and Lieutenant Birkheimer read the following paper:

SKETCH OF THE WORK OF THE SIGNAL SERVICE BUREAU FOR THE AGRICULTURIST.

BY WM. E. BIRKHEIMER, *First Lieutenant Third Artillery, Acting Signal Officer.*

The preparation of an essay on the subject of meteorology as it affects agriculture, which I understand was asked of me by this honorable convention, is a task that would require time and research to properly perform. A moment's reflection will suffice to show that, unless a person came prepared to do so, the presenting of such a paper, worthy of this assembly and occasion, would be an impossibility. The preparation would have required months, even years, instead of days.

Those who wish profound views on this subject, strengthened by the results of years of observation and experiment, enriched by the copious light of the philosophic mind of the writer, will find the papers of Professor Henry, published from 1855 to 1859 inclusive, a fountain whence they can draw both propositions and ideas based on facts worthy the age in which we live.

The publication of Mr. J. Lawrence Smith, of Louisville, Ky., on meteorology and the cotton-crop, is said to be a valuable contribution to this class of literature.

Blodget, on the climatology of the United States (1857) and the additional matter of later date, published by the Smithsonian Institution, the Agricultural, and other government departments will be found replete with valuable thoughts and suggestions.

Of foreign works on this subject the text-book on climatology of Lorenz and Rothe, which deals particularly with agricultural questions, ranks among the first.

To these sources among many others the student of meteorology in its effects on agriculture may turn for information.

While, therefore, an essay such as requested cannot be furnished, it has been thought that a statement of what the Signal Service Bureau has been and is doing for agriculturists might not be without interest to the members of this convention.

The meteorological division of this bureau was established in 1870, pursuant to joint resolution of Congress, approved February 9 of that year. The act provided for the giving of warnings to stations on the lakes and the sea-board of the approach and force of storms. The meteorological division in the first instance, therefore, could be considered as organized only for the benefit, directly, of commerce.

On November 1, 1870, the first weather-bulletin was published.

By act approved June 10, 1872, the Signal Service was charged with the duty of providing such stations, signals, and reports as might be found necessary for extending its research in the interests of agriculture. In executing this law it was found at first that the means of reaching the interior were meager and precarious. The proposed methods of communication with the stations were new to the telegraph companies, but obstacles were gradually removed so that in fact as well as by act of Congress, the Signal Service Bureau after June 10, 1872, commenced to devote a large part of its energies to serving the agricultural community.

A weekly chronicle of meteorological facts and data was commenced August 29 of this year; its object was to give a general summary of the meteorological conditions of the country for comparison with agricultural and other statistics, and generally to furnish information to those who wished to profit by the labors of the bureau, working with its new and increased facilities. Almost simultaneously with the publication of the Weekly Chronicle was sent out to the farming communities the Farmer's Bulletin, intended expressly to serve the interest of agriculturists.

Subsequently the Weekly Weather Chronicle was discontinued, and was succeeded by the Monthly Weather Review, which is still the standard periodical published by the bureau. Originally this was intended to present a general view of meteorological facts, particularly those showing the progress of storms, but in 1874 the scope of the Review was very greatly increased by the transfer to the Signal Service of over 500 volunteer observers, who had hitherto been reporting to the Smithsonian Institution, and of over 100 Army post surgeons who had been reporting to the Surgeon-General. The amount of data thereby accumulated, particularly that which is of interest to the intelligent agriculturist, is very great, and is all concisely summarized. This periodical is filled to a great extent with an immense mass of minute details on such subjects as the flowering and ripening of plants and grains, with facts attending the appearance of frosts, rains, floods, tornadoes, &c., within the scope of the field of observation, which, in 1874, due to the causes above-mentioned, covered well that part of the United States east of the Rocky Mountains, and, though with fewer stations, the territory west of that range. All atmospheric phenomena, whether taken cognizance of by the instruments, or the senses of the observer, are faithfully collated, summarized, and sent out from the office to those whose interests such information could serve; prominent among those who have drawn on this store-house of meteorological knowledge have been agriculturists and agricultural institutions.

While listening to the interesting papers read before this convention, and the no less interesting discussions arising thereon, the thought has often came up how much satisfaction gentlemen engaging therein—professors, farmers, investigators—would derive from perusing, as they appear month after month, the facts set forth in that Review. Nor is it intended for the learned and scientific alone. The results of investigations and observations are presented in graphic weather charts within the easy comprehension of the unscientific portion of the community. This periodical is, in fact, so well adapted to the wants of those interested in meteorology, both in subject-matter and style, that it has served as a model which several nations of continental Europe have copied for similar publications.

The condensed form in which tri-daily Indications and the special Bulletins are issued is a circumstance greatly to be regretted, but at present it is a necessity, in order that it may be possible to disseminate them. This distribution is done by telegraph, and, whether paid for by the United States or by the Associated Press, calls for the most economical use of words consistent with a clear expression of ideas.

The records of the bureau show that agriculturists, to an equal degree with any other class of the community, desire and are furnished with the tri-daily Indications and special Bulletins. To meet the needs particularly of the agriculturist the bureau has, since 1872, published the Farmers' Bulletin before alluded to, the name indicating precisely the object for which it is issued. It contains the indications of the weather for the district in which the station is located. These indications are telegraphed from the Washington, D. C., office at 1 a. m., and foretell the weather for the next succeeding 24 and 48 hours, reaching the rural population, for whose behests they are intended, from 12 to 40 hours before the time they cover expires.

Accompanying these indications for the district is a bulletin giving all facts of importance connected with the conditions of the atmosphere over the whole country taken as one mass, and viewed at one and the same instant of time in all the parts thereof. The general laws accompanying weather changes in the United States are given in the Farmers' Bulletin in clear yet simple language. Still further, the direction of winds that observations have characterized as wet or dry for that particular geographical district is therein set forth. In fact, there is compressed into this small sheet a great deal of meteorological information that is of interest and service to every thinking, intelligent agriculturist before whom it is placed.

It will not be forgotten that the reports to make up the information thus given out to the farmer come from Sydney, in Cape Breton Island; Roseburg, in Washington Territory; San Diego, California, and Havana, Cuba, as well as from 150 intermediate stations. This area is 3,000 miles long and 2,000 miles wide. By the telegraphic system of the bureau, observations, first placed in cipher to condense them into the smallest number of words, commence, within fifteen minutes of the time they are taken, to converge, by various paths, on the central office in Washington. When the wires work well an hour sees the last report in, and this time may be shortened or lengthened, depending on the telegraphic service. They are translated fast as received at the central office. The mass of data, systematically arranged, is placed before an assistant to the Chief Signal Officer whose duty it is to deduce therefrom forecasts of the weather. This duty is completed at about 12.45 a. m. Then commences the dissemination of the Indications and special Bulletins to the principal cities and rural printing stations where, between 3 and 4 a. m., the Farmers' Bulletins are found printed, addressed, and at the post-office ready for distribution. As a means for diffusing general knowledge on meteorological subjects among thinking agriculturists who cannot profit by the Farmers' Bulletin because of the isolation of the farm, or for other reason, the publications of the bureau are placed within easy reach of all who desire them for a sum in each instance equal to the cost price to the government of the material with which they are printed.

The work of watching, recording, and giving timely warnings by wire of the rise and fall of rivers was early in its history undertaken by the Signal Service. Stations were established with gauges to mark the fluctuations of the waters on the Savannah, Tennessee, Ohio, Mississippi, Missouri, Columbia, Willamette, the Sacramento, in truth on nearly every river of the United States, the valleys of which embrace interests, agricultural or otherwise, influenced by the rise or fall of their waters. In case of extraordinary floods the river observers are authorized to telegraph information to those interested lower down the stream without first referring the information to the central office. On the Pacific coast this is always done.

By this system of river reports, timely premonitions of the great freshets that annually visit the Mississippi Valley, with the changes of the waters of that river, can be given, and thus, in a measure, its levee system be protected, with the immense agricultural interests depending thereon. As with the Mississippi, so with the valleys of the other rivers, each with its agricultural, commercial, and manufacturing interests more or less extensive.

For some years attempts were made to furnish the people of Texas warnings of the approach of "northers," which, if their effects are not anticipated, sweep with such disastrous consequences over that and the country adjacent thereto on the north. During last summer a cordon of reporting stations was completed on north and west sides of a portion of the territory visited by these storms, and a systematic plan for giving notice of their approach was inaugurated for the benefit of Southern Nebraska, Kansas, the Indian Territory, and Texas. The plan for carrying out this scheme consists in sending notifications of the approach of northers to certain telegraph centers on the railroads traversing those districts. From these telegraphic centers the railroads order the notifications to be distributed to the stations on their respective lines.

Notifications similar to those sent the railroad centers are also furnished the officer in charge of the military telegraph lines, San Antonio, Texas, and by him sent to all stations under his control. As these warnings can generally arrive from 12 to 24 hours before the onset of the storms, agriculturists, ranchmen, and others, who are situated so as to receive notifications thereof, are enabled in a greater or less degree to provide against their effects.

This system of warnings is very popular with those whose interests it is intended to serve. It will be extended in scope as facilities for doing so are made possible with the Signal Service.

In 1877 the bureau was invited to co-operate with the United States Entomological Commission in collecting and summarizing all obtainable data relating to the origin, habits, the flight, and devastations of the grasshoppers or locusts which blight the face of the country in some western sections, like is related of the plagues in Egypt. All stations of the Signal Service west of the 93d meridian and east of the Rocky Mountains were directed from March to November to report, "the date of appearance of the locusts, the direction from which they came, the direction and velocity of the wind and state of the weather at the time of observation, &c.," and generally all information which, when systematically arranged and studied, will aid the entomologist to foretell with more or less certainty the undue and periodical return of noxious insects, and particularly the western locusts.

It is now one of the regular duties of observers of the service in the territory afflicted by this scourge to make report of all facts connected with these insects, with which they may become cognizant. Much of the data given to the public in the Report of the Entomological Commission was furnished by the observers of the Signal Service, and an important contribution to the subject of the hatching of locusts' eggs, based on our observations of temperature, has been made by one of the assistants to the Chief Signal Officer. During the summer just past, every preparation was made, through the regular and many volunteer observers, to have reports furnished the office of the movements of grasshoppers and locusts, but it is agreeable to report that in no instance has any mention of damage been made, although the insects made their appearance at a number of stations of observation. Probably in future years opportunity will offer to practically apply the system of prediction of flights of grasshoppers that has already been matured.

In 1879 a system of frost warnings for the benefit of the sugar industries of Louisiana was commenced. It consists in transmitting from the Washington office to the sergeant at New Orleans, notifications of such cold waves as will probably extend over the sugar-cane section, carrying with them reductions of temperature sufficient to cause killing frosts. The sergeant spreads the information, both through the press and by telegraph, to those interested in this branch of agriculture.

A service similar in all respects to this, but for the benefit of the orange growers of Florida, was initiated this past winter. Notifications of anticipated frosts are sent to the sergeant at Jacksonville; he, when directed so to do, telegraphing the warnings to Sanford in that State. From each of these places, as centers, news is distributed by all available means to those interested in orange growing. The warnings, as a rule, arrive from thirty-six to forty-eight hours in advance of the cold wave.

During 1881 a system of reports of considerable magnitude was instituted for the benefit of cotton interests in the South. Ninety-five stations furnished readings of maximum and minimum thermometers, and of rain gauges. The stations of observation were distributed pretty evenly over the cotton-belt, at least as much so as was practicable. The railroad and telegraph agents, with the consent of their employers, acted as observers. The cotton belt was divided into thirteen districts, each with its center for the collecting of reports; these centers being located at cities where were regular Signal Service observers; this precaution was necessary because of the duty devolving on the centers of consolidating and disseminating reports. The 13 districts were formed into 3 divisions, each with its center to still further facilitate operations.

Observations were taken at 6 p. m., local time, put into cipher, and transmitted to the center of the geographical district in which the station was located. Here a mean of the maximum, a mean of the minimum temperatures, and a mean of the rain-fall for the district is made up, and sent to the main centers of the respective divisions. The main centers, Atlanta, New Orleans, and Memphis, interchange reports, and then distribute them to the centers of districts. By this interchange of reports all the prominent cities of the South are supplied with information daily as to the temperature and rain-fall in the cotton-belt. Published in newspapers, bulletined at cotton exchanges, and other prominent places where business men assemble, this data comes quickly under the eye of thinking, interested men of the community, at these centers, or within the scope of their daily newspaper circulation.

The same information gathered and consolidated for longer periods of time, for a week, month, a year, or several years, could convey through the columns of weekly papers, monthly periodicals, and statistical tables, useful knowledge to the farmer as to the temperature and rain-fall that belongs to his or any other district of the cotton-belt, or of the belt viewed as a whole.

It is proposed to begin the service again this year, commencing April 1, 1882, and extending to October 31, 1882, with 140 reporting stations.

At the solicitation of wheat and other grain growers in the Northwest, the Chief Signal Officer has it in contemplation to institute a service similar in idea, and perhaps quite like this in detail, and in the interests of the grain growers of that section. When it will be put in execution is at this time undetermined; such schemes cannot be inaugurated in a day or week and operated successfully, but any delays that occur in the carrying out of this plan will be unavoidable.

With a view to rendering the Signal Service more valuable to the agriculturists of the country, regardless of sectional limits, the Chief Signal Officer has proposed to the governors of the several States the organization of State weather services which will be authorized by State legislation, and co-operate with the Signal Service in the collection of meteorological data.

From this system of reports we will be enabled to determine more fully the minute local peculiarities of climate of each section, and the Agricultural Department will be able to furnish the farmers with information bearing upon the culture of crops in the different sections of the country.

In the organization of the State weather services it is proposed to have at least one observer in each county who will report, by mail, at the close of each month to the chief of the State weather service, and from the reports received a monthly review of the weather will be prepared by the chief of the State weather service. Copies of the review will be furnished to each observer and to each county paper for publication. The results obtained from the local weather service will be furnished to the Chief Signal Officer of the Army in time to be made use of in the preparation of the Monthly Weather Review of the Signal Service, and will also be accessible to the Commissioner of Agriculture. Local weather services have already been organized in Iowa, Missouri, and Nebraska, and the organizations in the other States are awaiting the actions of the State legislatures.

There has existed a difficulty, and it exists now, in conveying warnings of storms or other useful information promptly and quickly to the farmer on his farm—when away from the telegraph line or the post-office, where the a Frmer's Bulletin is displayed. There have been a variety of methods proposed by different persons for overcoming this difficulty. One man suggests a signal be displayed on the passing railroad train. Another proposes to erect a very high pole on which to hoist a flag, light, or other signal so all farmers within sight of it may take warning. One proposes small balloons and lights. Another proposes to fire off cannon and thus propagate the news as to weather changes, floods, &c.

These are only illustrations; there are many other suggestions of a similar nature. The weak point in all these schemes, so far as the Signal Service Bureau is concerned, lies in this: that these persons, being irresponsible, would exercise their volition, hoisting signals or not as suited their convenience or fancy; and if mistakes are made by them, the community and the bureau suffer without means of redress. In the important matter of storm warnings, the bureau must have perfect control; unless this be so, the service will be compromised.

It is the earnest wish of the Chief Signal Officer that some methods may be devised whereby the service may be rendered more practically useful in preparing the farmer in his home for changes in the weather; so as to put him more nearly on an equality in this respect with those who have the advantage of telegraphic or telephonic communication.

If the honorable members of this convention can suggest any measures looking to this end, measures whereby the Signal Service Bureau can become more useful to the agriculturists of the country, the Chief Signal Officer will be glad to be favored with them. He will give them careful consideration, prompted by the desire to render the service of which he is the head directly useful so far as it is possible to the agricultural interests of the whole country.

The PRESIDENT. The Chair would suggest to the convention that a committee be appointed, to confer with the Chief Signal Officer, and after considering this paper, be instructed to make suggestions in a report to the convention, based thereon. The paper is a very valuable one, and if the benefits arising from the present work can be extended beyond those mentioned in this paper, it would be yet more valuable. The suggestion is made to me that the tobacco crop is exposed to injury from frosts, and a warning would save the crop from freezing. There are many valuable crops which could be protected from frosts by prompt warning. I suggest this in order that there may be inquiry in regard to this subject, with a view to the further action of this convention relative to their protection. These frosts are readily foreseen, and a little warning will save a good deal of property in that direction. I suggest that it would be in order for the committee to confer together, and then consult with the Chief Signal Officer.

Mr. ROBERT BEVERLY said: The revenues derived from tobacco are over thirty millions of dollars, and a warning of frost twenty-four hours in advance of its approach would often save at least one-half of the crop. I hope the subject will be fully discussed, so that the Signal Officer will be able to determine what protection can be afforded.

Mr. Holmes said: As regards a very extensive tobacco region in North Carolina, he would very much like to see something of this kind. There the crop has suffered considerably, and anything done by the bureau for the people will certainly be of great advantage to that State, and to the advantage of every tobacco section. I move that a committee of five be appointed to examine the paper read by Lieut. W. E. Birkheimer, entitled, "A sketch of the Signal Bureau work for agriculturists," and consult with the Chief Signal Officer thereon, and thereupon report to this convention.

The motion was agreed to.

Mr. Thomas Taylor, microscopist of the department, made a statement of some investigations he had made relating to the red rust of wheat, botanically known as *Trichobasis rubigo-vera.* These spore he stated were very small, measuring only about one-thousandth of an inch in diameter, but they multiply with great rapidity under favorable conditions. It is a matter of interest to the farmer to know what this rust is, what conditions are favorable to its growth and what will destroy it. Mr. Taylor states that each individual spore is the germ or seed of a distinct plant (a fungus), and that when it makes a lodgment on the leaves of grasses it subsists on them as a parasite, checking their growth. In order to test their powers of resistance to the action of various chemicals he submits them to the action of corroding liquids, then places them in a favorable condition for germination, and by the aid of the microscope, it is at once seen what class of chemicals will operate most beneficially in killing the spores. But a similar class of experiments is made on wheat-grains, and if it is found that while the chemicals that destroy the germinating powers of the rust have no evil effect on the seed-wheat, the chemical best adapted is selected for future experiments.

For sixty years past wheat has been washed with weak solutions of metallic salts, such as common salt, sulphate of iron, sulphate of copper, and sulphate of soda; but in all such cases the corrosive action of the substance used is very slight and by no means destructive to them. In fact weak solutions of these substances have a fertilizing value under many conditions, and *fungi* will grow in profusion on them.

These facts led Mr. Taylor to the conviction that washing the seed with these solutions would be of great value, by removing rust spores from the seed, since the spores in the washings, although not killed, would not find their way readily to the wheat fields, and in this way the destructive effect of the red rust would be greatly mitigated. He found as the result of experiment that seeds generally may be treated with sulphuric acid of commerce, full strength, without injury to their germs, while the spores of *fungi* and microscopic eggs of insects are completely destroyed. He had made many experiments in this line. Beans and pease he treated with sulphuric acid until the hulls shriveled, but they always germinated, and cotton-seed subjected to the action of strong sulphuric acid until the cotton fiber on their hulls was converted into a gummy mass germinated in 30 hours afterwards in a temperature of 80° Fahrenheit. Wheat and other seeds were severely treated with sulphuric acid, not with the view of aiding germination, but rather to test their acid resisting power in contrast with that of the spores and eggs of parasites generally. Mr. Taylor, in conclusion, recommended in all experiments of this kind to treat first on a small scale.

Mr. Blount had had a large experience with rust in wheat. For three years he had tested this smut, rust, and mildew question. He thought he could control rust as easily as smut, which is controlled by sulphate of copper, provided it is not in the soil. The rust is atmospheric, not in the soil. It may be left on the stubble of the old wheat. It tur from red to black and extends in long streaks, and this is the time injures the wheat. The only way to avoid the rust is in the first pla to improve the blade; second, improve the stalk, and make the applic tion after the wheat is two, three, or four inches high, because the ru is atmospheric. Sulphate of iron or blue vitriol will destroy these spor

He advocated planting on high, mineral land, and the application from one to seven bushels of common salt. If this is applied to s having 20 per cent. of silica, 99 out of 100 crops will be good. He h experimented with 36 varieties of wheat. Three years ago 30 of the rusted badly and he lost much of his crop. He applied salt and su phate of iron, and no rust appeared. Low land produces more stal more rust, and more imperfect and shriveled grain, whereas plantin on high land and the use of salt will make good crops.

Mr. RANDOLPH HARRISON, of Virginia, did not pretend to have sc entific knowledge of practical wheat cultivation, and hoped it would n be regarded as presumptuous if he questioned the views maintained i the paper. First, as to the hybridization of wheat. I understood hi to say that he regarded it as mechanical and not a work of nature. think he is wrong, and that it occurs sometimes through the influence nature. From whence have we obtained the many varieties that we ha before this artificial fertilization was furnished? For instance, Tapp hannock, a smooth red winter wheat, which is a variety of the Genne see flint introduced in Virginia by Bouton. He introduced this whe in that neighborhood and sold it at five dollars a bushel. Mr. Harriso obtained one bushel of it, and it holds its own with him. The exchange and the use of new varieties take place in all improvements, and one these hybrid varieties he had cultivated and found it utterly worthles Artificial fertilization is very rare in his section. I have tried to mi two different kinds of wheat, and so secure a mixture for use. I thin there is great advantage in this; it fills up the chinks, as it were, an then the whole will be fertilized by the foreign matter there. Thoug I could discern no form of hybridization going on it did seem to me t be going on. It had been long a mooted question also how much see to use. He would like to hear something on that point.

Mr. CARTER, of Virginia, said one of the most successful men he eve knew was a thick sower, using 2½ and 3 bushels of wheat to the acre He thought about 1½ bushels is right. We have not found that thic seeding, with less cultivation, will produce more than thin seeding wit more cultivation. It is a very significant fact that men urging this thi seeding have not succeeded in it; I mean by that using less than bushel. Colonel Carter had used three-fourths of a bushel for seedin and then did not make as much as that otherwise seeded. His land i light, and had no silica in it. Of course we know the stiffer the cla the heavier will be the yield.

Mr. SCHWITZER spoke of the importance of selecting wheat. Ver much depends on the quality and quantity of gluten. Gluten is a generic name, not known as a chemical, but which comprises vegetable fibrine and glutine. Flour, to make good bread, must have a certain percentage of gluten. Seed should, therefore, be selected having large percentage of gluten—12, 13, or 14 per cent. In the West a great many raise Clawson wheat, because it produces two or three bushels more per acre. Millers in Central Missouri pay 2, 3, and 5 cents less per bushel for this variety, however. The miller desires wheat that makes the best flour. He wants wheat the hull of which is thin, and sufficiently elastic to be shaved off in the process of milling. While exporters get e same price for wheat irrespective of the quantity of gluten, yet the peaker thought the time would come, and very soon, when grain will ot be bought by bulk or weight, but by the percentage of gluten. It desirable, in order to obtain the best price, to raise wheat that emraces these points. It is a matter to which chemists should give some hought. More attention should be given to the growing of wheat with eference to this characteristic.

Mr. **Blount** replied to Mr. Harrison, of Virginia. He would not say hat the hybrid could not be made naturally. There is a small insect hat may sometimes creep in between the clumps between the wheat rain and transport the pollen from that into another. Hybridization ates back 300 years. We now have in this country 350 different va-ieties of wheat. In reference to thin and thick sowing, he would say hat on an experimental plot, he had planted one ounce per square rod, ne-half of which seed he had soaked in blue vitriol, the other half being planted as it came from the machine. He raised 18 bushels and pounds from 48 square rods. It was sown in double rows, 12 inches part; then a space of 2 feet; in this space he run an irrigating fur-row. It was so thick it would hold a hat. On a field he had planted 76 grains, and had obtained therefrom 10¼ pounds, or at the rate of eighteen-hundred-fold. With regard to the hull, he said that they pretended to raise hard wheats, but they don't. Every wheat he receives is soft; but jus as soon as it comes to Colorado it grows hard, because of the dry air and alkali, which is conducive to wheat growing. "If you burn 1,000 pounds of wheat, you have 15 pounds of ashes. Those ashes contain about 33 per cent. of potash and soda. We have a Glauber salt called alkali, and that is the secret of our wheat raising." Refer-ring to the husk of wheat, Mr. Blount said that the millers in Colorado put the wheat in a bin of water, where it is soaked three or four hours. From that it is carried to the top of the elevator, and let fall through the air into another bin, and from that into another ten feet below, soaking the wheat three times before they put it in their mills. It comes out two clean pieces of bran.

The time having arrived for recess, the President appointed the following committee to take into consideration the work of the Signal Service Bureau: Holmes, of North Carolina; McBride, of the District of Columbia; Blount, of Colorado; Buchanan, of Virginia; Peabody, of Illinois. And then, at 1.06, the convention took a recess.

The convention was called to order at 2.50 p. m., Mr. Blount, of Colorado, in the chair. He announced a continuation of the discussion on cereals to be in order.

Mr. **Ingersoll** referred to the changes which wheat undergoes when grown for a certain length of time. In 1877 the question of the growth of Clawson wheat was raised at the State (Illinois) Agricultural College, and the result of observations when published was to raise the price of Clawson wheat 10 cents a bushel. Previously the millers had been decrying this variety as a poor wheat, but after these chemical examinations had been made the millers suddenly found that it was as good as any other brand. It was found that Clawson, which had been growing for three years in one locality, had improved in its qualities, and an analysis showed that it was better than that grown on other soils for a less length of time. So with the Diehl variety; at first the millers found fault, but after growing it for some time it was found to produce a better milling variety of wheat.

Dr. **Elzey**, referring to the quantity of seed wheat to be sown per acre, said that for the locality of Virginia he had found six pecks to the acre to be the best. He commenced with one peck, and increased one half peck to each acre until he reached three bushels. The largest yield was from six pecks, the smallest from three bushels, the two varieties experimented with being the Fultz and the old-fashioned blue stem white. He finds the matter subject to very considerable variation in different soils. The whole thing rests upon the tilling of the grain in different soils. He referred to the importance of the selection of seed for increased quantity of product, but the results, as given in the essay from such selection, were hardly probable. If Mr. Blount had had forty or fifty parallel rows and planted non-selected and selected seed, and the selected had yielded one hundred per cent. more, that would have been striking.

Mr. CHAMBERLAIN wanted to offer an objection to a conclusion deduced from facts stated without sufficient precision. He would be sorry to have some of the conclusions reached by this very able body go out with the indorsement of this convention, in regard to the quantity of seed to be sown. The gentleman before him made an allusion to this question, which is an old one. It has been discussed often before without getting as far as a satisfactory verdict. My view is, that on first or second bottom land a sufficient quantity would be, on a good soil, from one peck up to nine pecks. In Ohio the practice is to use between six and seven pecks at the agricultural college, and the same at the college in Tennessee. My own opinion is, that about six or seven pecks is the best quantity. I wish also to take exception to the statement that in Colorado they are independent of a drought, contrary to natural laws. Last summer, while in Denver visiting a friend, the president of the agricultural college had called on him for advice, and during the visit he made this remark: "Last summer we had no rain, and in consequence, we did not get a good stand, as we call it. I went all over that portion of Colorado. I saw and heard but one estimate or opinion, and that was, there would not be over twenty bushels to the acre in that Territory. I shall, therefore, take exception to the statement. I shall prefer Ohio, where the rain performs the work of irrigation, rather than Colorado."

General JACKSON. I would like to inquire of the gentleman who has just taken his seat if six pecks to the acre is, in his opinion, the best for purposes of seeding?

Mr. CHAMBERLAIN. Yes, sir; there is another entirely incorrect statement that I want to call attention to in this matter of land. One gentleman spoke of the necessity of having a certain percentage of gluten, both of quantity and quality. Increasing the amount, as suggested, would make twice as much, while if they increase to five hundred per cent. that would make flour worth twenty or thirty dollars per barrel. It is not at all likely that the value of the flour could appreciate in this ratio.

Mr. BROWN thought that some varieties of wheat raised on different places will produce different results in the amount of gluten. He had planted Clawson wheat and white Alabama wheat, and on examination of both varieties, some grown on upland unmanured land, and others grown on bottom lands well manured, some on manured uplands, he found the gluten in some varieties varied as much as five per cent., and the conclusion he reached was that the whole soil abounded in nitrogenous qualities, and that there is a larger amount of gluten where the larger amount of nitrogen exists; so that there is something in the soil which determines the quantity of gluten.

General JACKSON said: I wanted to ask a question of some of these gentlemen, whose experience in the cultivation of wheat is so valuable. I would like to say, in regard to the difference in the yield where the seed are broadcasted or drilled, that I understand that the general preference is in favor of drilling. How many bushels do you use to the acre, sowing in that way?

Mr. HARRISON. I think I stated that there was considerable difference in the soil in the two cases referred to, one of the soils being a little stiffer than the other, but there was no cultivation in either case. I have never known more than three or four cases of after cultivation. I agree with the gentleman from Ohio (Mr. Chamberlain), who has decided upon six pecks as the best quantity for seeding on Ohio sandy loam. Where the thin seeding was practiced, the yield was as good as ever; but in this case it should not be as thin as shown from Colorado. I should recommend from three pecks to one bushel, if it is a very large grain.

Colonel BEVERLY, of Virginia, was very much surprised to see so great a difference of opinion on a question of this character. He had been cultivating wheat forty-one years, and makes from twenty to thirty bushels of wheat to the acre, and if he had to abandon the drill he should abandon the cultivation of wheat. He was satisfied, from a long and careful experience, that it will make an addition of from twenty to twenty-five per cent. in the wheat crop in Virginia. They are subject to winter-killing frosts, or thawing one week at a time during the whole winter. The last winter was an exception, as we rarely had a thaw. By drilling seed, it is deposited in a trench, and the filling of the trench places it together. It sinks deeper in the spring, and does not become exposed; in broadcasting it springs up and stands out on the ground. As to thick or thin sowing, he had experimented on that, and he thought about three pecks to the acre was sufficient, if a man is particular to distribute it properly.

Mr. HARRISON had seen better crops of wheat from broadcasting than from the drill. He had seen them side by side.

Dr. ELZEY. Have you tried them with reference to the effect of drilling the fertilizer in with the grain?

Mr. HARRISON. No.

A member, speaking of smut, said he had stamped it out by using freshly slacked lime. He lays his seed-wheat on the barn floor, and sprinkles this lime on it. Those who drill cannot use this, however, as the grain swells and the iron would become corroded.

Mr. UPDEGRAFF was one of those who did not believe in drilling. This year he had best crop in his county—Jefferson County, Ohio.

Mr. DANIELS. What is the soil?

Mr. UPDEGRAFF. Limestone clay.

Dr. ELZEY. Did you use fertilizers?

Mr. UPDEGRAFF. Yes, sir; I have used it drilled in with the crop. I have planted out half the field drilled and the other half broadcast, and *vice versa*, always with an advantage in favor of the latter system. Perhaps at some time we will have a better and more rational plan of drilling, but to put all the seed in one little narrow streak is unphilosophical and wrong. If he were to raise a crop of wheat upon the success of which his life depended, he would broadcast it.

Mr. DODGE had made a statistical investigation some years ago relative to the comparative advantages of broadcasting and drilling. He had received returns from about a thousand counties, representing fully one-half of the entire wheat-growing field. In the Northwest, the spring wheat region, they favored broadcasting, while a very large proportion of the planters in the winter-wheat region favored the drill. The tabulation of these returns showed the increase to be about 10 per cent. by drilling, the advantages stated being that the seed was placed more evenly and at proper distances, and less superficially, and in that respect had the advantage of prevention of winter killing.

Mr. **BROWN**, of Brown County, Indiana, had been experimenting with wheat for fifteen or twenty years, and has adopted a theory of a smaller quantity. Two years ago winter wheat was raised entirely, 15, 16, 18 bushels to the acre; two years ago he sowed one-half of the field in wheat, one-half bushel to the acre, and one-half at three pecks per acre, and the half bushel seeding yielded the most per acre. Practice in Eastern Indiana is to sow a bushel and a half to two bushels; with broadcast they find that it will freeze out, hence drilling is generally adopted.

Mr. **FOSTER** found that with black lands he could hardly broadcast at all, because of freezing out, and broadcasting has almost been abandoned. A bushel and a half to the acre is about the quantity. They are now experimenting to know whether a bushel or a bushel and a half is the better quantity. He sows a bushel and a peck.

Mr. **PAGE** had experimented, at the University of Virginia, with half a bushel, three pecks, bushel, and a bushel and a half. The best result was from a bushel and a half, next best, bushel, and so on, three pecks being better than one-half bushel. In regard to drilling, his land was poor, and he had found very little difference between the fertilizers sown broadcast and wheat broadcast, or fertilizers applied in same quantity with the drill, though he made rather more from wheat sown broadcast.

Dr. **ELZEY** stated that throughout Southwestern Virginia experiments had uniformly been in favor of the practice of drilling in the guano with the wheat.

Mr. **JACKSON**, of Tennessee, doubted whether the use of the drill paid; he had used the drill, but found it too slow. A colored man on a mule sowing broadcast keeps up with ten double plows, and when they close at night everything is up. With the other plan he had never been able to get a gain exceeding two bushels to the acre with a drill, hence he had discarded the drills because broadcasting was productive of better net results.

Mr. **BEVERLY**. May I ask how much you get to the acre with that sort of cultivation?

General **JACKSON**. From 20 to 25 bushels to the acre.

Colonel **BEVERLY**. How much seed?

General **JACKSON**. A bushel and a half broadcast as near as we can; it may run to a bushel and three pecks, our object being to make the most per hand, and not the most per acre. I will compare with any grain-drill in that section of the country as to the net results going into the pocket.

Professor **HEDGES** said in 1832 he was in Tennessee, near Batavia, when he met a farmer of great observation, who made more wheat than the rest of his neighbors. The secret was he always put on from one to two pecks more than his neighbors. His measure is a bushel and three pecks. He always selected his finest and largest seed. He would take his sack of wheat and sit on the head of a barrel and throw the wheat out with an oscillating motion, and you could see the seed fall pretty close together, but you would not see any oats fall with the wheat, for they were too light.

Mr. **REYNOLDS** said the general practice of the most intelligent farmers is the best rule to observe in regard to these questions, and it is the practice of nine-tenths of the best farmers of Ohio, Illinois, and Indiana to use the same quantity of seed, and to drill it. Nine-tenths of the Dakota farmers broadcast it so as to keep the weeds from choking the wheat. With regard to the quantity of seed, nine-tenths of the farmers sow between a bushel and a bushel and a half. His recollection was, a bushel and three pecks, Clawson wheat, with one harrowing in the spring, yielded a total in four successive years of 205 bushels on one acre, and the quantity used was a bushel and three pecks to the acre.

Mr. AIKEN, of South Carolina, spoke at length upon the wheat growing of his section, and of the importance of being able to control the rust. He took issue with Professor Taylor relative to certain points, to which the professor replied.

Mr. WRIGHT, of the Indian Territory, asked General Jackson the kind of soil on which he sowed his wheat.

General JACKSON. Rather dark soil; black loam with clay subsoil.

Mr. WRIGHT advocated drilling, though he thought General Jackson was right for his locality. Temperature, climate, and latitude had much to do with it. To get rid of smut, he had advised his neighbors to put the wheat in brine that will carry an egg or potato. The foul seeds come to the top. In this brine he puts a little copperas, which kills the smut. The wheat, after being soaked in this brine, should be laid out on the floor and slacked lime sprinkled over it. The wheat is now coated with lime, and it must be put in the ground before it gets dry.

Mr. JACKSON. I would inquire of the gentleman from the Indian Territory, what would be the increased yield in a crop by subjecting it to this process over the ordinary method of fanning it?

Mr. WRIGHT. I should say it was nearly one-third, because better seed is sown.

Mr. JACKSON. It seems to me unless there is a very considerable increase in yield that it is a very troublesome experiment; in preparing seed for 200 acres, for instance. There seemed too great a degree of nicety.

Mr. WRIGHT. It is very easy to prepare the seed for whatever you require for each day's work.

Mr. BLOUNT. I would like to correct one thing. There are some who put smut and rust together. Smut attacks the head only. The rust appears on the leaf. The blasted head is caused by an insect which cuts the tap-root, as I have investigated and found to be the fact.

Professor TAYLOR referred to the importance of the preservation of seed, and his method of applying napthaline for destroying insects which infest it.

A MEMBER OF THE CONVENTION. I beg to state that the custom of fanning wheat, in order to prevent smut, is an old one, with which I have been familiar for forty years.

On motion of Colonel Beverly the convention at 4.45 p. m. adjourned.

MONDAY MORNING, *January* 16, 1882.

The convention was called to order at 11.20 a. m.

The president announced the receipt of the credentials of T. C. Johnson, of Gunnison City, also the receipt of a letter from the merino sheep breeders, regretting that they had not time to select their delegates for the convention. The first address to be made this morning will be by Professor Hedges, upon the sugar industry of the United States. Following that will be an essay on the cereal capacity of the Indian Territory, by General Porter. The third paper will be the history and value of agricultural statistics, by Professor Blue, and the last, "National and international crop reports," by Mr. Chamberlain. Colonel Harrison will preside temporarily this morning.

The chairman *pro tempore* introduced Mr. Hedges to the convention.

Mr. HEDGES. I have been delegated to appear here this morning for the purpose of presenting, as well as I may be able, a subject the importance of which it is difficult to comprehend, and which I approach with a great deal of diffidence.

Though I left the farm earlier than most men, yet I have clung close to it up to the present hour, and no man has greater interest in the progress of agriculture than I.

There naturally came to me, on the early introduction of this cane into the country, a desire to know more about it, and the part it was destined to take in the development of our resources.

I read the reports of Governor Hammond, of South Carolina, in 1856, and became much interested therein. I had the pleasure of a correspondence with him, and in one of my letters I put the question to him, "Do you consider that this cane" (which was then the Chinese variety) "is to be a staple crop of this country?" His reply was, "I have no earthly doubt of it." Then to me, as a farmer, a mechanic, and a manufacturer, came the determination to help it forward as best I might. At first, like the miner in the mountains seeking for gold, I found traces of the precious metal. I found the "colored dirt," and now I have found the gem itself, the evidence of which you see before you [referring to samples], collected from a wide area of this country.

Owing to the agitation of this subject throughout the Mississippi Valley, and owing, moreover, to the drought that had attacked the sugar-cane of Louisiana, the planters of that section determined, some time since, to make the experiment of substituting sorghum for the cane, and, anxious to know the results of these experiments before the meeting of the Cane Growers' Association, I recently made a trip to Louisiana to gather all obtainable information upon the subject. I met the members of that association, and to them repeated the story of sorghum, and at my solicitation they sent delegates to the association, and if it please the convention to hear the report of the leading men who attended that body, I will have it read.

The secretary read as follows:

Mr. T. W. NICOL, of Louisiana, then read the following important communication:

Mr. PRESIDENT AND GENTLEMEN: Having engaged during the past summer to a small extent in the cultivation and manipulation of orange sorghum cane, I would respectfully ask the attention of the convention to some remarks and data on that now all-important subject.

In a great country like ours, where every article of food for mankind is produced, and where its agricultural products exceed that of any other country in the world, it would seem strange that sugar (which is consumed by everybody) has received so little of our attention as an agricultural industry. We, in Louisiana, in developing sugar growth, have had much to contend with, the principal things of which consisted in reclaiming our lands from overflow, and the introduction of machinery in manipulation. You, I apprehend, with your national reputation for enterprise and energy, have paid most attention to the propagation and production of the cereals, or staff of life, now controlling, as you do, the price of grain in the markets of the world. But, my friends, we Americans find that to make life comfortable we must have the "sweets" of life.

We all know the history of the introduction of the beet-root into European countries, the fostering care with which Germany, France, and Russia guided and gradually advanced sugar culture, until to-day those countries not only produce all their own sweets, but actually enter into competition with that great sugar country, the Indies. In the early colonial days of our country a premium was offered to those settlers who engaged in the production of grain. Well, as I said before, our capacity for grain production has assumed immense proportions, and we have never a fear in the future but that production will keep pace with increased population, and certain it is that a great nation will never suffer so long as food is plenty within her borders. But, gentlemen, let us examine the statistics and see if sugar is plenty. Surely, aye, positively not, when we produce only 12 per cent. of the quantity consumed. Then it were time to study the subject, and, if I know our people, if I am not wofully disappointed in the tremendous enterprise I have witnessed *en route* to your Queen City and in your country, I say, then, we are equal to the emergency; and if we declare that we are equal to the task, where is the remedy? Well, we are doing our best in Louisiana; we are fertilizing, building, improving, and husbanding. But our country has been a sugar-cane country, and when I say sugar-cane I mean that specimen brought many years back from the tropics, brought into our country almost accidentally, and when finally introduced here found, of course, to be an exotic, and surrounded by all the troubles of a new agricultural plant, the history of which I might dwell upon, but which is not the purpose here, for we have to deal with only stubborn facts and positive results.

Mr. Hedges and other gentlemen in this country have discovered another sugar-producing cane which, in the opinion of many in our section of country, bids fair in the near future to enter largely as an important factor in saccharine products.

During last summer and spring we found ourselves with small crops of stubble and indifferent stands of plant cane, and several of our planters bought of your orange cane, with a view to giving the mooted question a thorough investigation. The season was late and we were suffering with drought, and made a very poor stand all round, many not getting sufficient to pay a trial in the sugar house, but I persevered and finally got a good stand of cane on 1.81 acres of land, which I ground and manufactured into sirup with the following result, which was duly published in our county paper, and which I have brought along here. Owing to the fact that our refinery was disordered (having some improvements under way) we did not boil for gain, but satisfied ourselves as to the financial result of the trial. Just below us on the river, Mr. Williams, of Oakley plantation, Saint Gabriel Point, got a very nice sugar, which brought him 8¼ cents in the New Orleans market, being graded as good common second sugars. Captain Brown, of Anchorage plantation, Port Allen post-office, made a strictly prime second, or common off white. In neither instance did these gentlemen give me their tonnage, hence I cannot give as good an exhibit (owing to their bad stands) as some which follow. * * * It will be noted from the table that from one acre $30 net was realized, quite a handsome net revenue from a first trial. Now, on this same 1.81 acres of land I housed the heads and intend shortly to thrash out the seed, weigh it and pass it to the credit side of statement. Again let me say that from the first crop stubble there grew a luxuriant second crop, which, owing to the lateness of the season, I fed to our stock until frost killed it. I am satisfied from my experience that two crops of orange cane can be grown and manufactured into sugar or sirup.

Now, gentlemen, the sorghum interest is a new one to you, as well as to ourselves, and let me warn you, from the large experience which we have had in sugar cane, that you may not travel over the same ground we have, commit the same errors we have. A slight allusion to the management of a large sugar estate will best exemplify my meaning. Taking an estate comprising (in area) 1,300 acres in all and 900 in cultivation. We have in one building, central sugar factory, over $40,000 in machinery, leaving out cost of original plant and general plantation improvements. We keep these improvements insured constantly, but only use them 60 or 75 days out of 365. Now add to this interest on cost, wear and tear on machinery, and tax, and we have an annual expense of, say:

Interest on $40,000 for nine months	$2,400
Wear and tear lying idle, say 5 per cent	1,500
Annual improvements	500
	$4,400

Whether the buildings be small or large, the rule operates in proportion, and estimating the value of sugar houses in Louisiana at $10,000,000 we have an annual loss of say $1 300,000. As a strictly agricultural people this is radically wrong, and we are rapidly coming to the conclusion that a change must be made, and that change will be made in this wise: Large estates will be cultivated on the co-operative plan, they will be divided up into small holdings and the cane brought to mill and sold to the "central factory," and very soon, instead of having a sugar manufactory on each farm, we will have them only at intervals, covering such territory as the capacity of the mills in their maximum will demand. This is the plan of the future and we will very soon have a home for thousands in sugar, whereas but lately these same lands were non-producing. When the beet culture was first inaugurated in France the farmer then borrowed his ideas from the Indies and fell into the same path that we have followed for three-quarters of a century. We all know the failures in France at the start, and we also know that it was through the intervention of the government, the expenditure of large sums of money in central factories that finally made the culture and manufacture of the beet a success there; so let us warn you—centralize your sorghum culture—put central factories where tons enough of the cane can be produced to justify the erection of machinery perfect and modern and of large capacity. I could extend this paper to volumes in giving items as to the manipulation of sorghum juice, but will say that the mode is absolutely similar to sugar cane juice, and in the near future we hope to become so identified with you as sugar growers that from time to time we can forward to you such data as you may require. In your new departure, on the very threshold of your industry, I say, adhere to the production of pure sirup and sugar. We give it to you as our experience that pure sugars can be made from sorghum and sugar cane without the introduction of deleterious chemicals. Avoid the insinuating speculator who would induce you to use them. We owe it to our posterity to produce health-giving food, and I offer it as a prediction that unless you do as we do in Louisiana, manufacture a pure, unadulterated sugar, your new-found industry will amount to nothing.

It is with feelings of gratefulness that we come here at your solicitation. We greet you as fellow-farmers of a common farming country, for, indeed it is true that the farmer in his noble calling is the solid rock of our country. We sincerely hope that in the near future sugar will not be solely a Louisiana crop. We are not a selfish people, and being assured that you are not, we look forward to the day when the sweets of life (sugar) shall be as much a product on the wintry banks of your great lakes as it is now in one narrow little country down South, where the sugar-cane has been known to blossom, teeming in richness of saccharine. Then, friends, let us hope that this new industry of yours will prove as great a success as it deserves, and that there will soon be as much sugar produced in our country as we consume. With thanks for your attention to my remarks I will close.

You will perceive at this day in the West there were many who doubted whether Louisiana would meet us half way. We had cheerfully extended the hand of fellowship, and we expected it in return from the farmers of that State, and hoped that this would result in the certain progress of this great industry. We only lack, gentlemen, such skill and steady, straightforward effort as will make this movement a success. We want no inflation; no exaggerated accounts; nothing of the kind, sir; we want to go to the bed rock. This industry will acquire prominence through the example of many of our Western men like Bozarth, of Cedar Falls, Iowa, Hon. Seth H. Kenny and S. A. Stout, of Kansas. Mr. Stout has been more recently in the business than the other gentlemen whose names I have mentioned. They all learned their business thoroughly, and made it a great success, and the result of their labors has been to lay by money every year.

Mr. Kenny, who is the vice-president of our agricultural association, said to me recently, "I have cleared about $3,000 this year." He started years ago with a little mill and worked up until he made $3,000. This year he is working up to two-thirds the capacity of his mill, and will probably lay by about $5,000, then he will be compelled to hold back, for I question whether he can get hold of enough cane immediately to extend his work much more.

Mr. Bozarth's sugar [indicating] is here. He sent us four barrels to Saint Louis. This was swung off by the centrifugal, as appears by the report I have. When this sugar was shown to the merchants on its arrival in Saint Louis, they said it was worth too much for them to buy it. If we were to buy that we should not refine it, but put it on the market. We buy coarser sugar than this for purposes of refinement. Mr. Bozarth was able to sell this sugar at 8½ cents, but Mr. Belcher said it will not find a market in the city, as all the buyers would like probably this or that [indicating coarser grades]. They would not give what it was worth. Mr. Bozarth has this year added 100 acres.

It will be proper for me to make some reference to what I have heard at this convention. These are the kind of men I like to talk with—thorough, practical men, who are familiar with this question which we are considering.

Mr. Bozarth has a fine farm 5 miles from Cedar Falls. On this farm he produced his sorghum, and with the proceeds bought cattle. He said:

> I accumulated money every year, and a few years ago I concluded I was making my money on cattle. I stopped the sorghum work and let it all drop; sold my apparatus and tried cattle alone. At the end of two years I had not made a dollar, and I went back to sorghum, and for two years I have cleared nearly $3,000 a year, putting up the works, and starting with 200 acres, and now have 400 acres of sugar, and my works are run by steam.

This increase in the extent of his production his experience qualifies him to make, and he will make it a success. Mr. Bozarth says that in all business, and it is a very singular expression, "If a man is to succeed, he must go after success as he would after a wife; he must fall in love with the girl, and hug to her through life." I say through the reports of this association that every farmer could do likewise and accumulate property by adhering to business and make it a success. Make it a first consideration in your efforts. In the morning think the first thing of your cane crop. The seed has been in the past too much a matter of secondary consideration. It has been kept out in the field. In Louisiana they waited to see if the stubble would not come up, and then waited till it was too late to plant the cane. You cannot plant too early, it is your money-making crop, and you must not wait until it is too late to plant. The experience of Mr. Stout is the same as that of Mr. Kenny. This is the type that is to be taken; select a man of experience in our business. Many men had larger crops than these farmers, but none so great a per cent. Look at Louisiana twenty years ago, and look at her now! What a difference I have observed between that time and the present. Inasmuch as I am the only representative of Louisiana here, I will say this: If Louisiana, with her present condition, had not the protection which the government affords, she would sink out of sight in a year.

I had a confidential conversation with one of Louisiana's first men recently, one of her largest capitalists, and he said to me, that from the upper sugar districts to the coast, that there was not one planter who could pay his debts if pushed. We are, he said, all poor; we had to rebuild our sugar establishments in Louisiana. The bankers of Louisiana loaned us the money to rebuild them. They could not be rebuilt on the old, cheap plan, but new factories had to be erected in accordance with the improvements of the day, at a heavy expense, so as to enable them to roll out the refined white sugar, suited to the demands of the time, and it is necessary that they should have this help in order to swing out from the centrifugal this Louisiana sugar from the cane. No other foreign element than the lime and the sulphur fumes are applied down there, and you see them throwing the sugar out in great snow-banks, with ten or a dozen men at work. They had to incur an enormous debt to get the machinery to do this. And now if they can be supported for a time, until liberated from this heavy debt, get their lands improved, and get the help they need from the North, they may be able to attain great success if you stand by them.

The **CHAIRMAN**. Is the sugar by that process bleached with sulphur fumes?

Mr. HEDGES. Yes, sir. There is no special method for treating sugar. They have been treating sugars these hundreds of years, and in all my reading I have found that there is but one straight-forward method to bleach the juice. They first pour it through a machine in which there are fumes of burning sulphur, which, on being passed through water, produces sulphurous acid, and in which the juice being thrown down into a spray is bleached, and the first step after that is to simply treat it with lime, boil it down, and nothing else. Of course, all juice from Louisiana is boiled down in the vacuum, which, you will all understand, takes off the pressure of the atmosphere and enables them to boil at a low temperature—temperature of about 140°, no hotter than our morning's coffee. The reason for this is that, should it be boiled at a high temperature, it is converted into what is known as "caramel."

Mr. GILHAM. Will the same process that the Louisiana planters employ for clarifying and whitening their sugar do for whitening the sugar of sorghum?

Mr. HEDGES. It will; if they can produce the same quality of cane, then the same process will produce the same results.

Mr. GILHAM. I shall ask two or three more questions before I get through, and before the points pass out of mind. What kind of soil, in your experience, is the best for producing this kind of cane?

Mr. HEDGES. My observation is that a calcareous soil, in which sand, loam, and clay are combined, or a sort of mixed soil. If you go into a bare, sandy soil it is probable that you may fail in some very dry seasons. The sandy soil of New Jersey, for instance, has produced good results. As regards fertilizers I will say that this crop is one of the most sensitive crops in the world where fertilizers are used. Some years ago I received canes, in sections of about six inches, from Utah, from an intelligent gentleman who used to act as correspondent of mine, and the juice of these samples was as saline as our hotel soups are. Of course it partook of this flavor from the soil in which it was grown; and it is a fact, which is well for us to understand, that in fertilizing, the greatest care should be observed, and here comes in the value of agricultural stations, to whose work I look as the salvation of our sweetness.

Mr. GILHAM. What would you consider the best methods of procedure to insure success to the common farmer?

Mr. HEDGES. I should advise the small farmer to attempt small works at first, and increase his works as success increases. His cane should be cut, at the proper time, and he should go forward steadily in that line, seeking the advice and studying the writings of those who have been successful.

Mr. GILHAM. I wish to ask you right there in regard to books. There is a great deal written in books that is not true, and what our common farmers want is facts. What do you consider the best quality of seeds, what are the several varieties, and what are the best for different soils in this country?

The CHAIRMAN *pro tempore.* If the gentleman will allow me, I think it might be better to let Mr. Hedges get through with his address, and then there will be an opportunity to ask him questions.

Mr. GILHAM. But it is important that we should take these points up as they occur and discuss them, otherwise we might neglect them, after the speaker has finished.

Mr. CHAIRMAN *pro tempore.* The gentleman must not misunderstand me; of course there can be no objection if Mr. Hedges is willing to be interrupted.

Mr. HEDGES. I have no particular boundary for my address; I wish to speak to the pleasure of the convention.

Mr. GILHAM. I feel that Mr. Hedges is a servant of the people, and I think I can safely say that he is willing to answer the questions of any gentleman present.

Mr. HEDGES. The question is quite germane to the inquiry, and in answering it I will say, with regard to the seed, that I have watched them closely, and that they have become as voluminous in names as it is possible to imagine, and my answer to inquiries of this nature is this: From my present view and knowledge of the subject I would plant but two varieties in all latitudes south of about Springfield, Ill., the Early Amber and Early Orange; I would plant them both for the reason that the Amber will give you earlier working, while the Orange will follow it and give you later working, and a larger crop ordinarily, for it produces one-third more to the acre, while it contains quite as much sugar. South of the mouth of the Ohio River the Orange will ripen early enough. The Amber cane is tender compared with the Orange, for two reasons, the first is that the shell of this cane is thin and is more susceptible to the sun's rays on this account, while the shell of the Orange is heavier, and is covered from joint to joint with a thicker coat, which protects it from these rays; and the same reasons might apply to the effects of frost, for it seems as though nature had intended it for a more southern climate, being a later cane, by furnishing it with this overcoat for the frosty nights.

Mr. A. C. BOYNTON, of Pine Hill, Tex., who made the best sugar from sorghum, and which polarized 97 per cent., found that his Amber cane suffered severely as soon as the weather became hot and dry.

The CHAIRMAN *pro tempore.* If the Chair comprehends the last question I do not think that Mr. Hedges has answered it exactly. We know that in Louisiana the principal profit is on sugar, and the molasses is incidental. Now, if sorghum was grown here would that be the case?

Mr. HEDGES. In New Jersey the people have so much faith that it will be the case that they recently contracted, I understand, for 1,200 acres of sorghum to be delivered next season.

The CHAIRMAN *pro tempore.* You have been telling us something about the manufactures in the West.

Mr. HEDGES. I have referred to Louisiana. So far as the West is concerned, I can state nothing beyond the reports that I have. The past season the works at Faribault, Minn., have made a large amount of sugar; this, however, was by the use of coal filters, a vacuum-pan, and centrifugal. I know of no particular instance among the mass of farmers where this industry has been taken up and pursued for a sugar product, but this is probably owing to the fact that their molasses sells so readily and at such a profit. I will, with the consent of the convention, read the report of a gentleman from Illinois, Professor Scoville, who has given considerable attention to this subject:

Mr. HEDGES read as follows:

Professor Scoville, of Illinois, read a paper on the subject of sorghum sugar, going into chemical and analytical details and processes of manufacture, in an interesting manner, giving as a result of the cultivation of one acre of cane the following:

600 pounds of sugar, at 8 cents per pound	$48 00
85 gallons of molasses, at 40 cents per gallon	34 00
Total	82 00

Expenses	$37 50
Net profit	45 50
Sale of glucose	20 00
Total profit	65 50

Mr. DANIELS. Where did that cane grow?

Mr. HEDGES. At Champaign, Ill. Professor Scoville has been working at this matter for two or three years, and you see that his net profit is $45.50, and then he has estimated the amount of glucose susceptible of being made from the seed at $20.

DELEGATE FROM MARYLAND. Right there may I ask you a question? I have seen a statement that on a Louisiana plantation a little over 3,000 acres produced in sugar and molasses over $100,000; more than was raised on the great Dalrymple wheat farm with seven times the amount of land. Have you any data by which we can get at the correctness of that?

Mr. HEDGES. I have not, sir. I have heard the same thing stated before, but I have never seen the report of the product of an acre of cane. There were other statements of net results besides that of Professor Scoville, though not carried out so carefully. The demand for sirups is constantly increasing, while the methods of making sugar in Louisiana and in sugar-houses of New York, Boston, Saint Louis, and in other sections of the country, are so improved that they do not make more than 40 per cent. of molasses thrown off as they used to do. They granulate to a high degree, and the molasses thrown off is not so good or pure, because the extra amount of sugar obtained detracts from the value and the quality of the sirup. I will now have read what Professor King said.

The secretary read as follows:.

I propose to submit for your consideration a few sample tests and illustrations, as well as a few quotations from a reliable scientific report of an analysis of seventeen samples made for and reported to the board of health of the State of Michigan by Prof. R. C. Kedzie. I make these few quotations from an extended article in the Louisiana Sugar Bowl, of December 22 (a paper largely devoted to the sugar interest). This full report should be carefully read by every person who considers their own health important.

No. 1. Pure cane-sugar sirup.

No. 2. Starch-sugar sirup. Contains some sulphate of iron (copperas), and contains in each gallon 107.25 grains of lime.

No. 3. The grocer called it "poor stuff." I have seldom seen an article that better sustained its recommendation. Made of starch sugar, contains plenty of copperas and 297 grains of lime in a gallon.

No. 4. Nearly pure cane sirup.

No. 5. Starch-sugar sirup. Contains copperas and 100 grains of lime in a gallon.

Nos. 6, 7, 8. All made of starch sugar. Contains sulphate of iron and plenty of lime.

No. 9. All the members of a family in Hudson, Mich., were made very sick by eating freely of this sirup. A starch-sugar sirup. Contains in the gallon 71.83 grains of free sulphuric acid, 28 grains of sulphate of iron, and 363 grains of lime.

No. 10. Contains starch sugar, copperas and lime; amount not estimated.

No. 11. A starch-sugar sirup. Contains in the gallon 141.9 grains free sulphuric acid, 25 grains sulphate of iron, and 724.83 grains of lime.

No. 12. Contains starch-sugar, seasoned with sulphate of iron and lime.

No. 13. Starch-sugar. Contains in the gallon 58.48 grains of sulphate of iron, 83.14 grains of free sulphuric acid, and 440.12 grains of lime.

No. 14. Starch-sugar. Contains in the gallon 80 grains of free sulphuric acid, 38 grains of iron, and 262.48 grains of lime.

Nos, 15, 16. Contain starch-sugar, sulphate of iron, and lime.

No. 17. Starch sugar, sulphate of iron, and 202.33 grains of lime.

A very important element in this discussion is the great disparity in sweetening power between cane sugar and starch sugar or glucose. One pound of cane sugar has the same sweetening power as two and a half pounds of glucose. In these starch-sugar sirups the public is not only treated to compounds loaded with foreign and injurious materials, but they are enormously cheated in the very thing they seek to buy, viz., the sweetness. Sugars and sirups are bought not as articles of food solely, but entirely for their sweetness, and thus the buyer is largely defrauded out of the very thing for which alone he makes a purchase. The thought of using such mixtures as a relish for our food is not very appetizing. Some of these drips seem to be made up of about equal parts of fraud and dirt! A facetious friend has quoted in this connection the old saying, "A man must eat his peck of dirt before he dies." If any one feels uneasy lest he be defrauded of "his peck of dirt," let him eat a few gallons of No. 11, and he may rest on his laurels for the balance of his days.

My attention was called to the evil effects of these glucose sirups by a business friend in this city some four years ago; he said his children were feverish and restless at night, without appetite, and pale; he said he was using these drips, and that they had been eating freely of them; I suggested a change to sorghum, which he did and found immediate relief.

I am aware that some chemists will say that well-made glucose is not unhealthy because, they say, that nature in her processes of digestion transforms our starchy food into glucose before assimilation takes place; but will they claim that nature uses sulphuric acid and lime to do it?

The Early Orange seed which he planted produced a cane which did not turn red in the center where the Early Amber did. Let me say a little more in regard to the different varieties. I have just asked of the department for a list of the different varieties of cane which they intend to distribute, and, looking down the list, from a knowledge of all the names of all the varieties introduced by Mr. Rhey, the African and the Chinese variety called sorghum, I did not find but one single variety of either of these names, and that was Neeazana and Early Orange. The color of the juice and the seed is similar to the Orange, and, therefore, they call it the Early Orange. Then comes the Early Amber and the Gray Top and the Honey. The Honduras is a Neeazana, Liberian is another; White Liberian is another name applied to it, but there is no such cane. There is a Nesbit cane in variety, but Mr. Stumpson says, "It is hard to tell how it got the name."

A MEMBER (interrupting). Do I understand that they are names of one variety?

Mr. HEDGES. They are picked up. You can select the names you please.

A MEMBER. Are they all of one kind?

Mr. HEDGES. They are of the Chinese or African family. Rhey numbers fifteen varieties.

A MEMBER. When you select a variety which do you prefer?

Mr. HEDGES. I would buy Early Amber and Early Orange for our locality.

A MEMBER. Are they African or Chinese?

Mr. HEDGES. They are both members of the African variety. I do not think they have the same appearance as the Chinese. The latter has been almost abandoned. You see them once in a while.

Now, in the matter of the distribution, I hesitate to say anything which would look like instructing the department, but, at the same time, I have a letter which I will ask Mr. La Dow to read, after I have briefly alluded to it, referring to the distribution of seeds by this department. If I had all the varieties at once, I would not scatter them promiscuously all over the country. I would endeavor to acquire the knowledge which would enable me to send these various seeds to localities to which they were adapted. One locality is not sufficient. Here you could not develop that which in the Mississippi Valley would be most productive. I would send to the different establishments these different varieties, and let them report back. Then, if it prove successful, it could be generally established; but if not and they did not suit the people, they could be rejected. Suppose it is announced by some speculator that he will furnish a new kind of seed at fifty or sixty cents a pound, a great many will at once respond, ordering the seed, and the multiplicity of names in the country renders this an easy matter. My advice would be to send these seeds out into the country to persons who will test them and report back. Then go forward and distribute to the masses, but not until then. Then you save the people from becoming the prey to speculators.

The following letter was then read:

SAINT LOUIS, *December* 29, 1881.

DEAR SIR: The facts concerning my little experiment with northern sugar-cane as food for live stock are as follows:

Early in May, 1881, I purchased of you ten bushels (600-weight) of sorghum seed, I think you called it Early Amber, and sowed it broadcast on old timothy sod, plowed under to a depth of about eight inches between the 15th of May and 20th of same month. From the time of planting until about the 8th of August, when I cut the crop, the rainfall in Saint Louis County was almost imperceptible. Notwithstanding the dry season the cane grew finely and maintained a rich green color. The crop was cut with an ordinary Wood's mower. Just after the cane tasseled, and after lying upon the ground for four or five days, I had it bound in large bundles and stacked it as I would have done with wheat or oats.

About the middle of November I hauled one stack into my barn and commenced feeding it to my stock, consisting of cows, horses, Shetland ponies, and sheep; they all ate it ravenously, and I have never seen them in better health or looking better at this season. My cows in milk and work horses are fed grain also, but the other stock have subsisted upon cane fodder alone since the middle of November. Prior to the middle of November I had been feeding corn fodder to my milch cows with two feeds of corn bran per day; upon substituting cane for fodder an increase of about 25 per cent. in my butter product was at once perceptible. I planted ten acres of corn for fodder about same time the cane-seed was planted and upon the same character of soil. The former grew only about three feet high and dwindled to about nothing under the combined efforts of drought and heat, when as has been heretofore said, the cane flourished and produced a large crop. Both cane and corn were sowed broadcast and covered with an ordinary farm harrow.

In repeating the experiment I should prefer to use a wheat drill, as I am satisfied the crop would be improved by this method. The cane came out of the stack in prime condition, and I observed no tendency to rot or mold. A friend of mine who made the test describes the stalk as tasting like sweet pickle.

I think I made a mistake in not sowing more seed to the acre, a little over one-half bushel being the amount I used, but even under this mistake I never saw land cleaner and better prepared to sow grass-seed than this was when the crop was removed.

I cannot, of course, say what would have been the result if the season had been wet instead of very dry. It is possible and probable that the process of curing would have been difficult and the percentage of loss in consequence greater, but my experience has satisfied me that for the purposes for which I use it, cane fodder is in every respect superior as food to Hungarian, German millet, or fodder corn.

Hoping that the foregoing will fully answer your inquiries,

I am, very truly yours,

THOS. T. TURNER.

ISAAC A. HEDGES, Esq.

Mr. HEDGES (continuing). The Honduras cane is the largest that has been brought here. It occurs to me at this moment that I have been told by some one who raised it, that it would take four or five months to ripen. It is an immense cane. I found some in Louisiana, and when I took it to some of the Louisiana planters, they doubted the propriety of using it, but for all that, I urged them to try it. They did not like it because it was too soft, but later in the season it got more of a solid stalk. These varieties can be well tried in the hands of the people. These are my views on that subject.

Mr. Bozarth was the treasurer of our association. I employed a stenographer to take down the proceedings of our convention, and I presume it is now published in pamphlet form; and our treasurer took the responsibility of publishing and distributing it, calculating to sell it for what it cost. Mr. Bozarth is fully reported in that book. He claims to have made from 140 to 200 gallons of sirup to the acre. It can go much higher in a favorable season. It has been in such great demand and the supply at hand has been so small, that he can sell it readily for 45 cents a gallon, and could have got 50 cents. Nevertheless, he found that one-third of all the sirup boiled would granulate in spite of all his efforts to prevent it.

Mr. DAVIS. Is there more money made in making sugar or sirup?

Mr. HEDGES. We will leave the Mississippi Valley for the present. We learn from the report of Mr. Cook, that Mr. Hilgard has for some years been making large profits. He says that he went to Mr. Hilgard's of New Jersey, to get a report of the result of the conduct of his sugar works. Mr. Hilgard said, "I have no report to make." "Well," Mr. Cook replied, "I am going to the convention of Saint Louis, and they have requested me to procure what information I can about the matter." "I have none to make," he replied.

A MEMBER. Who was at Hilgard's place, who wanted a report from him?

Mr. HEDGES. The New Jersey Agricultural Association had offered a premium, and Hilgard was contending for it, but he would make no report. He had made some 2,000 tons of sugar and has about 1,200 acres of land in cultivation right around his works. He said that he found it necessary to control the supply of cane, and sometimes he could not get enough. He said that he had bought this to make a supply on. This I give as an illustration, showing which way the wind blows. Here is a man with a plantation of 1,200 acres, equal to the best plantation in Louisiana.

I will say that when men talk to me about making a first-class sugar by chemical process, and compare it with nature's process, it is like a man making medicated whisky.

I do not know that I have any other question to speak of. I have probably kept the floor as long as I ought.

The CHAIRMAN. It is a very interesting question.

Mr. HEDGES. There is a report of H. W. Wiley, which comes from Indiana. I will read that as it will throw additional light on this subject. He tells the true story of the condition:

> To secure a good article of sugar for consumption is a matter of no little importance to the American public. So great has become the consumption of this article that a variation of only a small per cent. of saccharine matter involves annually millions of dollars. Consumers should insist on knowing from dealers the character of the sugar which they purchase. First of all, it must be granted that the sugar which is most valuable to the consumer is the crystallizable cane sugar, whether it be derived from cane, the sugar beet, or the maple tree.
>
> To detect the amount of such sugar no other means can compare with the polariscope. Pure cane sugar has the power of rotating the plane of polarized light 66.7 to the sight. All other sugars act on polarized light, but in different degrees. Happily we can detect the exact amount of cane sugar in a mixture of any number of sugars whatever. I will not undertake to describe this process, which is of interest only to the practical chemist. I will only say that the polariscope carelessly used may give rise to the most alarming errors, while on the other hand its judicious use will lead to results which are entirely trustworthy. In the sugars which I have examined I have found only three impurities which need to be brought prominently to the notice of the sugar-makers and the sugar-eater.
>
> First. *Water*. Water is certainly a harmless ingredient; nevertheless we object to paying 8 cents a pound for it. Many low grade sugars will be found to contain fully 10 per cent. moisture; while on the other hand first-class refined sugars will have less

than ½ per cent. Obviously in buying sugar it is of great importance to determine the amount of water which they contain.

Second. The next ingredient which is of importance commercially is invert sugar. This is only found in low-grade sugars, and is not present in white refined sugars in quantities sufficient to impair its qualities. This sugar arises by conversion of cane sugar by high temperature or prolonged boiling, or by the action of the acids natural to cane juice. Invert sugar is the chief ingredient of molasses, aside from the uncrystallizable sugar originally in the cane.

Third. The next ingredient which I shall mention, and the one greatest in commercial importance, is starch sugar, or amylore, which is mixed with cane sugar to increase profits of sales. I have examined a great many of these mixed sugars and have found the per cent. of starch sugar varying from 20 to 50 per cent. The starch sugar, when well made, in my opinion, contains no deleterious ingredients, and the only objection to its use is found in the fraud which the mixing perpetrates on the community. Starch sugar is now made as white as the finest refined cane sugar, and is capable of being reduced to a fine powder suitable for mixing, To the unpracticed eye these sugars readily pass for the genuine article and thus readily find their way into the trade. The quantities of these mixed sugars are great, and from the data I have been able to collect I place the total amount at not less than 2,000 barrels a day.

To detect any or all of these adulterations the polariscope is almost a necessity, and consumers would do well to demand of dealers some guaranty of the purity of the goods they purchase.

If there is no other question, I will simply close by saying that the erection of works on a large scale ought generally to be confined to stock companies. For, in the present stage of this business, if the uncertainties and danger of loss are to fall on the shoulders of an individual during the first year of an industry it would be beyond their capacity to sustain the loss; and while gentlemen may each put in a little, many could not stand under such a misfortune alone. I understand that not many of those engaged in this industry have met with favorable results, such as paying dividends, &c. They are, however, encouraged, while the season has been one of the most severe ever known. The grasshoppers have never cut it, and the chinch pays no attention to it. Its foes are late planting, and in the form of heavy rains. The men to whom I have referred are determined to go forward. There is no intention on their part of faltering or deserting this industry, and the people of the Mississippi Valley will never abandon it. They will carry it on and make it a success. I thank you for your kind attention.

The CHAIRMAN *pro tempore.* But a few minutes remain before the time will arrive for adjournment. There is not time for the reading of another paper. The chair will suggest that any questions which will bring out matters of interest touching this subject may be asked by any of the members and the public, and with the concurrence of the committee, will suggest, inasmuch as another committee has also been appointed, whose duties have been somewhat similar, that we hear from that committee now.

Mr. GILLHAM. We have occupied some time on this sugar question, and our time is growing short. The committee that was appointed on pleuro-pneumonia is ready, and would like to report if it be the will of the chair and convention to hear it.

Dr. ELZEY. The proposition the gentleman has just made should be adopted, and we should occupy the remaining time of the morning hour in receiving the reports of the committees. There are two, I think, of one of which I am chairman. We have had the matter in hand for several days, and it should now be disposed of, while the discussion on sorghum can go over until after the recess. I therefore move that the convention now dispose of the reports.

The motion was agreed to.

Dr. ELZEY. I was appointed chairman of the committee raised for the purpose of presenting the subject of pleuro-pneumonia among cattle to the consideration of Congress.

Mr. GILLHAM. The committee appointed by the convention to secure all bills presented to the last Congress relative to this subject, and to examine into the methods of their workings, is now ready to report, and Dr. Law will read the report.

The CHAIRMAN *pro tempore.* Is there objection to the consideration of this report? (After a pause.) The chair hears none, and the secretary will read.

Professor Law read the following report:

REPORT OF COMMITTEE ON LUNG PLAGUE.

Your committee, appointed to secure all bills offered in the last and present Congress treating on the subject of the extinction of the contagious pleuro-pneumonia of cattle, with the view of recommending legislation, beg leave to report that they have had them under consideration, and herewith present them, together with the recommendations below. In the various bills we have found provisions for other objects than the extinction of contagious pleuro-pneumonia, and believing, as we do, that the special urgency of this case demands speedy and specific action, we recommend the passage of a single act for this exclusive purpose.

This we advocate in view of the existing yearly losses of millions of dollars by the contagious pleuro-pneumonia, or lung plague; of the steadily increasing danger of the extension of this disease to the open grazing grounds of the West and South, with the certain increase of the losses to tens or hundreds of millions; and of the certainty with which this plague, exotic to our land, can be early stamped out and permanently excluded from the United States, which cannot be said with equal confidence of any of our other existing animal plagues.

The extinction of the existing germ would be the extinction of the disease for all time on this continent, unless reimported.

2d. While heartily approving of Federal legislation upon other contagious diseases of animals, for investigation, experiment, exclusion, limitation, or extinction, as well as for statistics on animal industries, yet we are unanimously agreed in the opinion that no such object should be provided for in the same act with lung plague, nor should any money appropriated for lung plague be made available for any other such purpose.

3d. That in view of the terrible losses that would accrue from the extension of this lung plague, we are of opinion that such extension should be provided against by the prohibition of the movement of any neat cattle out of an infected State into any other State or Territory, or the District of Columbia, excepting under a quarantine of three months, to be controlled by a veterinary sanitary organization designated by Congress. This we consider the first duty of Congress in this matter, being a measure of protection which is an essential prerequisite to all effective measures for stamping out the plague, and one which cannot be constitutionally applied by the States, but must be done by the Federal Government in accordance with the clause that Congress alone can regulate inter-State commerce.

4th. That in the matter of the extinction of the lung plague in the different infected States and in the District of Columbia, we recognize the difficulties that attend the construction of a statute which shall enable the Federal Government to operate effectively within the individual States for this purpose, and if the wisdom of Congress cannot devise an effective measure of this kind, we would strongly advocate that a sufficient appropriation should be made out of the Federal Treasury to meet the greater part of the outlay of the different States in carrying on this work; such money to be disbursed by some designated officer of the Federal Government, on the approval, by the above-named veterinary sanitary organization, of the method and execution of the work conducted by the State authorities for the extinction of this plague.

5th. In advocating such an appropriation we would represent that the infected States are not liable to be so seriously injured by the extension of this plague as are the States as yet uninfected, so that it is even more for the interests of the latter than for the infected ones to have the disease speedily *stamped out;* also, that, according to the best authorities, two million dollars judiciously applied would more than suffice for the complete extinction of this lung plague of cattle, while we are now, in consequence of its existence, losing considerably more than two million dollars yearly on our exports of cattle to Great Britain alone; and as these cattle for export are mainly furnished by the West, this loss is almost exclusively a Western one.

The most essential measures for *stamping out* the disease in infected districts are the following:

1. To prohibit all movement of cattle, except by special permit.
2. To prohibit the pasturage of two or more herds in one inclosure, except under special permit.
3. To prohibit the pasturage or exposure of cattle on highways or on any other place not securely fenced.
4. To prohibit the turning of infected or suspected cattle into pastures adjoining a highway or other pastures occupied by cattle.
5. To establish, in the ports of New York, Philadelphia, and Baltimore, bonded markets for the reception of cattle from uninfected States for distribution and export.
6. To secure, under proper veterinary supervision, the prompt destruction of all cattle suffering from or infected with lung plague—acute or chronic—and the disinfection of all yards, buildings, cars, boats, places, and articles that have been exposed to contagion.
7. To provide a liberal indemnity for all cattle, promptly killed under condemnation of the official veterinarians for the purpose of stamping out the plague.
8. To provide suitable penalties for failures to report the existence of the disease, and for any other transgression of the rules made under this law.

D. B. GILLHAM.
JAMES LAW.
HENRY C. MEREDITH.

Accompanying this report were sundry bills introduced into the last Congress, as follows: House bills Nos. 6871, 6925, 1351, 6513; Senate bills Nos. 1473, 1893, 2097, 1908.

The CHAIRMAN *pro tempore*. It seems to the chair, that in order for the convention to act intelligently on these resolutions, some enlightenment might be advisable. For instance, not being an expert in cattle, I, for one, do not know whether this lung plague is identical with pleuro-pneumonia.

Dr. ELZEY. They are identical. They are two names for the one disease.

The CHAIRMAN *pro tempore*. Then, is there any reason why they should not go out as the sentiment of this convention?

Dr. ELZEY. My resolution is simply such as would make it appear as a preamble for these resolutions. At first we thought of merging them into one, as my resolution was what might be styled a "glittering generality;" and then we thought it might be introductory to them. And I now move the adoption of the report read by Professor Law; and that a copy of it be transmitted to Congress.

The motion was agreed to.

The CHAIRMAN *pro tempore*. The time has arrived for the usual recess.

Mr. DANIELS. It is understood that the sugar discussion takes precedence this afternoon?

The CHAIRMAN *pro tempore*. I presume so, if it be the pleasure of the convention.

The convention at 1.08 p. m. took a recess until 2 o'clock.

The convention reconvened at 2.23.

THE PRESIDENT. The remaining papers for this day's consideration are, first, "The cereal capacity of the Indian Territory," which General Porter was requested to present at the opening of the afternoon session to-day; the "National and international crop reports," which has been assigned to this afternoon; and "The history and value of agricultural statistics."

The Chair will now be very glad to listen to General Porter.

Mr. DANIELS. Allow me, Mr. Chairman, to say that the matter of sugar was under discussion, and I believe it was the sense of the convention that that discussion should be continued.

The PRESIDENT. The Chair will suggest that one morning occupied with one subject ought to be a fair allowance in such a convention as this. The Chair has no desire in the matter further than that we should consider the wants and rights of other gentlemen. The whole matter is in the hands of the convention. I merely announce the assignment.

Mr. PORTER. It would be very difficult for me to present anything in reference to the subject that has been assigned me that would be of practical value. I can present no accurate data as to the cereal capacity of the Indian Territory, but, for the information of the convention, I will ask Mr. Dodge to read the statistics of 1880 of the grains grown and stock then in the Territory owned by the Chickasaw, Choctaw, Cherokee, Creek, and Seminole tribes.

Mr. DODGE. This statement is made up from some official figures on record in the Indian Office in this city.

The following is the table read by Mr. Dodge:

	Chickasaw.	Cherokee.	Choctaw.	Creek.	Seminole.
Population	6.000	19,720	15,800	15,000	2,667
Acres tillable	2.500,000	1,600,000	3,000,000	2,300,000	70,000
Acres in reserve	5,031,351	3,215,495	6,683,000	4,650,935	200,000
Acres cultivated in 1880	92,398	65,000	100.000	40,000	17,009
Acres broken in 1880	......	2,500	5.500	5,000	....
Bushels of wheat	58.424	78,000	200,000	....	....
Bushels of corn	726.042	200,000	1,200,000	....	220,009
Bushels of oats and barley	52,568	20,000	50,000	....	2,000
Bushels of vegetables	190,000	150,000	150.000	80,000	25.000
Tons of hay	70,000	22,000	20,000	12.900	1.500
Horses	13,512	18,000	17,441	10.000	2,500
Mules	1,239	1,300	999	1.500	100
Cattle	66,746	100.000	48,294	77.000	5.000
Swine	107.721	50.000	138,561	100,000	4,000
Sheep	14,442	7,500	9,792	2,000	200

Mr. PORTER. You will observe that these statistics cover only the five tribes of the Indian Territory, known as the civilized tribes. Aside from the tribes here mentioned, there are some twenty-eight or thirty small Indian tribes that have been located in the western part of that Territory by the government, where they are now being taught agricultural industries. I am unable to furnish statistics relative to what is being done there. Now, in regard to the Indian Territory, it will be remembered that that part of the public domain was set apart by the United States Government, under the act of Congress passed in 1830, for the occupation of the Indians, and the President was authorized to locate Indian tribes in that country, removing them from States further east, and giving them such areas in the Territory as would be sufficient to give them sustenance. Then it was understood, as remarked a few days ago, that that whole country was a desert, and in setting it apart for Indian occupation I remember that the government believed that it was a country peculiarly adapted to the Indians, a country abounding in game, but unfit for agricultural purposes, and hence beyond the limit of civilization, and beyond what civilized man would ever want.

The Territory has proven to be a country that can be made useful for other purposes, and from time to time portions of that country, originally set apart for Indians, have been carved out and States have been made from them—Nebraska, Kansas, and other Northwestern States. Now, what I wish to say will be in regard to that part which is still known as the Indian Territory, and which is located between Kansas on the north, Texas on the south, Arkansas and Missouri on the east, and Texas partially on the west. Formerly the productive capacity of that country has been found to have been very much underrated, but in latter years my impression is that it has been very much overrated. We raise in that country corn, wheat, oats, barley, potatoes, and in fact all the vegetables that are raised in Kansas and Missouri, and in addition we find that the raising of cattle and of horses could be made most productive of wealth to our people. Over our country grows grass that feeds the stock without cutting it, and the beef that we raise in that country yields us greater profit than any grain we ever attempted to grow. Corn has not been raised to any great extent from the fact that there has been no demand for it except for home consumption, and the five civilized tribes have always raised more than home consumption demanded, unless drought caused a failure, and enough to furnish the bordering community from north to south, from Texas to Missouri and Kansas to Texas.

I have lived in that country for forty years, during which time I have made some observations; having been brought up on a farm, and having traveled all over the country I have reached some very positive conclusions with regard to its capacity, and what it was by nature ordained to do. In the first place, while the land along the river bottoms is very rich, and capable of producing a great deal of grain, a greater portion of the country, which is the high prairie country, is dry and produces grass only; whenever it is broken up for a few years it produces grain pretty well, but on account of the winds, which sweep from the Missouri to the south, which occur generally in the spring and fall, and which continue for thirty-six to forty-eight and seventy-two hours, the soil being of a light texture blows away, and in five or six years its productive capacity begins to fail, and shortly afterward that which remains is gravelly and sandy. The older fields that we have will produce nothing. Now, that same soil when left to grow the grass which nature has planted will produce more value in beef and cattle to each acre than can be produced from any variety of grain.

It has occurred to me, from a careful observation, that a great part of this Territory was never intended for an agricultural country, and can be made so only by planting trees that shall protect it from these driving winds. Like all prairie countries the Indian Territory is covered with innumerable little hummocks, or you may say something resembling pock-marks on the surface of the prairie. These are caused by little animals burrowing into the soil and bringing it out in the process, and then during the hot periods, when the ground becomes very dry, these driving winds carry before them all the soil they catch at these places. The heavier soil remains, but this, without being mixed with other soil, produces scarcely anything. At one time I observed a fact which may not, however, be of any value. Some years ago the grasshoppers from the Missouri prairies came down in that country making their camping ground on these sandy fields. They went into the fields and destroyed the wheat in the fall, laid their eggs in the fall, and in the spring destroyed everything that was planted. The result was that the following year grasses that had never grown in that country came up on those lands where they camped. These included the western grasses that grow along the mountains, and the buffalo-grass.

Again, in 1868, they besieged us, sweeping over all the prairie country, and wherever they went these grasses are coming up in little bunches. This incident suggests to me that that country is better adapted to grazing than to other purposes, and that these grasshoppers were the means provided to introduce these heavy grasses in the place of the lighter ones, and which are destined to protect the soil from being blown away. While this country may eventually be made a fine cereal growing country, I think it would be much better if stock were made the principal industry of that country at present, and after awhile the tramping of stock over the country, and the growth of trees, may help to make the production of cereals its chief and most profitable industry.

Mr. **Wells**, of Ohio, on behalf of the President, extended to the National Agricultural Association an invitation to meet the President in the evening, and the following resolution was unanimously agreed to:

Resolved, That this National Agricultural Convention accept the courteous invitation of President Arthur, and that we pay him our respects by calling at the White House at 9.30 this evening.

Dr. **Loring**. Is there any further consideration of the question?

Mr. **Wright**, of Indian Territory, hoped that not only the cereals but also cotton would be remembered. This has been raised more especially by the Choctaws on the Red and Arkansas Rivers. Those people have raised most of the cotton on bottom lands. It is a useful production, and is carried on by quite a number of those who were born there. We have no farming business on a large scale. Cotton raising is entirely confined to the eastern part of the Territory, and the western part is better adapted to the raising of stock. In the Choctaw country there grows what is called mesquite, and you will find the plains covered with cattle. In that part of the country, near the line of the railroad, cattle are successfully raised, though few are exported. There is an abundance of grass on these plains especially adapted for stock. It does not equal the blue grass of Kentucky, of course, but is an excellent grass for feeding stock, and you may go where you will and find plenty of it. Our stock is very well fed.

Mr. **Hedges** suggested the use, as the forage of the country, of cane and sorghum. A letter from Colorado, where the cane was planted, and where there was no rain from the time it was put in the ground until the last of July, showed that they made a good large forage crop of this plant. It attained a height of about five or six feet, and being planted early it withstood the driving winds. It could be put in in the fall. We have been very successful planting it in the fall. It will come up in the spring, and I am confident that more can be grown to the acre than if it were planted in corn. Then after this is grown and cut it can be sowed again, and give them a cereal crop at the rate of 25 or 30 or more bushels per acre.

Mr. **Foster**. I move that we proceed to the reading of the next essay. Adopted.

The **Chairman**. The next paper is on national and international crop reports.

NATIONAL AND INTERNATIONAL CROP REPORTS.

By W. J. Chamberlain,

Secretary of Ohio State Board of Agriculture, Columbus, Ohio.

Mr. **Chairman**. I need not, in this presence, argue at any length to show the importance and value of prompt and reliable crop statistics. It is now pretty generally conceded that an accurate knowledge of the present condition of the crops month by month is the only legitimate basis of prices and of trade. It is also coming to be conceded that the Agricultural Departments of State and nation are bound to furnish such information *to the people month by month* in the interests of business, commerce, and agriculture, and to see to it that the information is accurate and impartial; that is neither in the interests of "bulls" nor of "bears," but of truth.

Heavy speculators obtain this information more or less accurately for themselves, and at great expense. If the mass of producers and consumers are to have similar information in the interests of justice, truth, and fair and equitable prices, then State or national agencies must furnish it; and this I believe can only be done by concerted action, by a full and cordial co-operation of State boards with the national Department of Agriculture.

With a view to securing this harmonious action, as well as more full action in the several States, an "inter-State" convention of State boards of agriculture was held in Springfiled, November 30, to December 2, 1880. The proceedings, papers, and discussions of that convention were widely published in the Western daily and agricultural papers, and in full in pamphlet form for distribution, and had great influence on the legislatures and boards of agriculture at the West, some five or six having decided to issue crop reports.

The present National Convention, called by Commissioner Loring, was most clearly foreshadowed and urged in several of the papers, discussions, and resolutions of that convention. One entire paper, suggested by the committee that called that convention, and prepared by Dr. R. T. Brown, of Indianapolis, formerly chemist of this department, was on "The relations of State boards of agriculture to the National Department." From this paper I quote briefly:

"The several State authorities come in contact with the agricultural interest at two points, two wit: the agricultural colleges and the State boards of agriculture.

The misfortune that paralyzes the active usefulness of both these institutions is, that while they maintain only an indirect relation to the State, they have no relation to each other, nor to the department at Washington. The result is that neither realizes the usefulness it is capable of."

And again Dr. Brown says:

"We have at Washington what was intended to be the head of a great agricultural organization embracing all the States and Territories, but it remains merely a head, with no limbs or body through which to act. In nearly all the States we have boards of agriculture, organized by State legislation, and acting within their own jurisdiction, entirely independent of each other. I think the present convention is the first attempt to obtain concert of action, in any degree, among the State boards. The initiative of this action should have been taken by the department at Washington years ago—not, indeed, in the spirit of dictation, but by way of invitation for mutual counsel and advice, to the end that such relations might be established as would bring all the State boards into direct communication with the department, and through it, with one another."

Thus clearly and exactly was this present convention foreshadowed and its need felt; and it is simply one proof of the wisdom of our present able Commissioner that he made it one of his first official acts of any leading importance, to call just such a convention to bind together the many weak and disconnected threads of individual and State aid into one strong cord of unified national action and valuable result. I call your attention to some of the resolutions of that first convention:

"1st. That we believe the time has fully arrived when each of the States represented by us should undertake the work of issuing prompt and accurate monthly crop and stock reports during the growing season.

"2d. That in our opinion uniform and concerted action among these States in this matter will secure results most valuable to the agricultural and business interests of the country.

* * * * * * *

"4th. That in order to determine the fair market value of the annual grain and live stock products of the United States, it is necessary to obtain the earliest and most complete information attainable as to the extent of the foreign supply of grain and live stock, and the surplus for the markets of the world, and the proper officers of the government are therefore earnestly requested to obtain, through the consular and other foreign service of the United States, the most complete possible data concerning the extent of the annual production of grain grown in foreign countries, and the condition of the growing crops as the season advances.

"5th. That the information so obtained be given to the Associated Press, and be forwarded through the national Department of Agriculture to the several State boards of agriculture at the earliest practicable date after receipt.

"6th. That the several State boards of agriculture collecting live-stock and crop statistics are requested to reciprocate and forward such reports to the national Department of Agriculture as promptly as possible.

* * * * * * *

"9th. That all the grain and meat-producing States of the West and South be cordially invited to unite with us in our next meeting to be held next year at the call of our executive committee."

Before the executive committee referred to above had named the time and place for the second inter-State convention Commissioner Loring had, with broad and liberal views, issued the call for the present National Convention. The executive committee, therefore, were in doubt for a time what was wisest to be done; but finally decided to issue a call for the inter-State convention to meet at Chicago at the time of the Fat Stock Show, partly with a view of indorsing this call of Commissioner Loring, and appointing special delegates to attend this National Convention, and of urging all our boards to respond cordially to this call. The discussions and full interchange of views in that convention resulted in a series of resolutions unanimously adopted. The first three acknowledge the necessity of and demand for prompt and accurate monthly crop reports in each State; recommend uniformity of action; offer a detailed plan for collecting these statistics in the several States, and pledge the hearty co-operation of the boards there represented. The remaining resolutions I give in full.

"4. That the prompt consolidation and publication of these monthly reports from different States can be best accomplished through the national Department of Agriculture, and we recommend that all important final footings in each State be telegraphed to the Commissioner at Washington, not later than the 8th day of each month of the growing and harvesting season.

"5. That an executive committee of nine be appointed to attend the national convention called by Dr. Loring, United States Commissioner of Agriculture, and to be held in Washington the second week in January, 1882, and that said committee be authorized, in consultation with Commissioner Loring, to arrange all details necessary to harmonize the work of the State and national departments, and render it more efficient; and, especially, to prepare blanks to be used in common by all States in this monthly statistical work.

"6. That in order to determine the fair market value of the annual grain and meat products of the United States, it is necessary to obtain information as prompt and as reliable as possible, month by month, as to the condition and prospects of the foreign grain and meat product, and consequent probable demand for our surplus, and that, therefore, we urge our most able United States Commissioner of Agriculture to obtain such information through our consular and other foreign service (through courtesy of the Department of State), and publish it promptly through the associated press, and send it by telegraph to the secretaries of all State boards that furnish like information from their own States to the United States department.

"7. That we urge each State to use every effort to perfect its own system of monthly reports, making it so prompt, thorough, and accurate that the United States department shall not be compelled to go over the ground with a separate corps of correspondents; but being relieved of this drudgery of detail, shall have the more time and force for other important work in the interest of agriculture.

"8. That we are gratified to notice the call referred to above as made by Commissioner Loring to a national convention in the interests of agriculture, and urge upon all who are officially in charge of the agricultural interests of the different States to respond to that call, and make that convention beneficent in its results."

The resolutions were unanimously adopted, and the executive committee mentioned in resolution 5 was appointed, and is now in attendance here.

I have given the resolutions of these inter-State conventions thus fully to show that the West is ripe for and demands this statistical work. And I am sure our State and national departments of agriculture can in no other way, at so small an expense, confer so great benefits upon the farmers of the land as by furnishing this kind of information.

Our papers and discussions for these two days on our cereal products naturally divide themselves into two classes: first, those that relate to production, and second, those that relate to distribution, sale, and consumption. But the questions how we shall increase the amount and diminish the cost of production, are not more important than those that ask how we shall *obtain just prices for our products*. And while the *farmers themselves* can largely solve the first class of questions—can buy or propagate new and improved seeds, conduct experiments, study methods, processes, fertilizers, breeds, breeding, and the like *without aid* from State or national departments—yet it is impossible for them to gain a correct knowledge of the probable supply of and demand for the grain product of the world *except* through State and national aid. Heavy speculators, indeed, can and do get and use such information as I have said, but the individual farmer cannot. And I need not argue in this presence to prove that it is or the promotion not only of our agricultural interests, but of the general interests of business that both producer and consumer should know the real condition and probabilities of the crops as the basis of an equitable adjustment of prices. For if the heavy speculators alone know the condition of the crops, they can "bear" the markets until the crop is bought at too low a figure for the facts, and so defraud producers, and then "bull" the market until they have unloaded at too high a figure for the facts, and so defraud consumers. And it is plain that the interests of agriculture are best promoted and future production is most stimulated and increased when *the farmers really get the fair price* for their products and the dealers simply get the fair compensation for the risk and cost and skill of handling the product.

For example, if the 100,000,000 bushels of wheat produced annually by the two States of Ohio and Illinois is through the farmer's ignorance of facts sold at $1 per bushel when the real facts of demand and supply and the tendency of prices justify $1.25, then the 25 cents per bushel or the $25,000,000 goes largely *into the hands of speculators* to enrich them and become dead capital or to be expended in our cities on mere luxuries that shall, in no way, increase the fixed and *productive* capital of agriculture. But if the *farmers* get this $25,000,000 it goes largely into better buildings, implements, stock, fertilizers, books, papers, and real agricultural education that *shall assuredly increase the total future products of the soil.* In short this vast sum is then turned into *real productive capital,* into agricultural prosperity, that shall also increase our *commercial and national* prosperity for years to come.

Consider now for a moment our foreign grain demand, its magnitude and its vast increase. Our total wheat export for the fifteen years preceding and including 1877 averaged in round numbers 46,000,000 bushels annually. Since then it has averaged 170,000,000 bushels annually or nearly *four times as much* in total bushels. For the fifteen years our total export was 18 per cent. of our total product. Since then it has averaged 37 per cent. or, to repeat, our *per cent.* of export has *doubled* and our total export has almost quadrupled.

A simple table shows this clearly to the eye:

Bushels of average annual export for fifteen years up to 1877 =	46,000,000
Bushels of average annual export for three years since 1877 =	170,000,000
Per cent. of export to total crop for fifteen years up to 1877 =	18
Per cent. of export to total crop for three years since 1877=	37

If, then, we consider the single fact that we are now annually exporting *more than one-third of our entire annual wheat crop,* it will at once be seen that it will not do to neglect this foreign demand as a factor in estimating or prognosticating the *tendency of prices,* or, in other words, the legitimate and probable price of wheat. Especially evident does this become when we remember the additional fact that this foreign demand is *exceedingly variable.*

Compare the exports of two pairs of years:

In 1877 the export was, in round numbers	54,000,000
In 1879 the export was, in round numbers	146,000,000

Or nearly three times as great. Again:

In 1878 the export was	89,000,000
In 1880 the export was	178,000,000

Or just twice as great. The increase was largely due to disastrous failures in foreign crops, and these failures might have occurred alternate years instead of in succession, *i. e.,* two good crops and then two poor crops.

And yet, notwithstanding this vast and exceedingly variable export demand, the astounding fact meets us that up to the present time we have had *absolutely no official means* of ascertaining and publishing to our producers and consumers the *real condition* of the European and Asiatic crops. And so, as a people we have "sat in darkness and the shadow of *financianl* death," until a few heavy dealers and speculators who could afford to *pay for and conceal* this knowledge that the government should give to the people, have swept the board and taken the profits that should have gone largely to the producers. For our heavy grain speculators know the value of such knowledge and have combinations with one another by means of which they get it promptly and with approximate correctness. With branch houses or special agencies in many lands and by concert of action they inform one another, and their correspondence is as frequent as occasion requires, even though it necessitates the daily use of oceanic cables.

All this is legitimate. The information costs them much money, even into the ten thousands for some single firms. It belongs to them and they are under no obligation to divulge it, and *they never do.* Not only that but there is nothing to prevent the constant, persistent, and most diligent publication of false information, reports from foreign lands (?) exactly the reverse of what is true. And that such misleading reports are actually and most industriously published, no one can doubt who calls to mind the notorious fact that the actual and alarming shortage in European crops for the past four seasons has been concealed and stoutly denied in this country each year until the bulk of our wheat crop was largely out of producer's hands, and the profits were in the hands of heavy dealers. And this large amount of gold made by speculators might just about as well have gone out of the country, so far as relates to our agricultural and financial prosperity, indeed much of it does go out for foreign luxuries.

Nor are the producers the only ones benefited by accurate monthly crop reports, but consumers and even legitimate dealers who buy for actual delivery. And these actual dealers earnestly favor such official crop reports.

One of the heaviest grain buyers of Central Ohio, who is present in this convention as one of the delegates from our State board, was himself the one who nearly two years ago offered the resolutions establishing the bureau of monthly statistics in our board, and placing $1,000 of our State fair earnings in the hands of the secretary, and instructing him to begin the work, even before we knew whether our legislature would vote a dollar for its continuance or not. To the credit of our legislators be it said that as soon as they found our board was really doing this practical work for the advancement of the agricultural and business interests of the State, they promptly, and I think unanimously, voted all the funds we needed to perfect and carry on the work. And I may here remark that the same will, I am sure, be true of our other State legislatures and of our national Congress. If our State boards and our national Department of Agriculture once show that they "mean business," that they have really grappled this great work demanded by the people in the interests of agriculture and of business, then sufficient funds will be speedily forthcoming. For this work is plainly demanded by all except the few who hope by withholding or perverting facts, to enrich themselves at the expense of the many and of the general good.

An important question is, how shall this work be systematized and divided up between the national department and the agricultural departments of the different States, so that all shall work in perfect harmony, the whole ground be thoroughly gone over, and none of the work be unnecessarily duplicated with results so variant and contradictory as to throw discredit upon both.

I think the *foreign* work—that of finding month by month the condition of the crops of the old world—must be done by the national Department of Agriculture. Our State boards cannot well handle it. Just how this vast foreign work shall be done I will not attempt to indicate, and am glad to leave it with perfect confidence to the wisdom of our Commissioner. For at least we have a Commissioner who holds the reins as if he knew how to *handle the team*. It is no light task to map out the nationalities of the world in comprehensive form, and show the population, production, consumption, including seed, and the consequent surplus or deficit of each, and thus deduce the grand total of the whole, viz., the closely approximated export demand, and our home surplus to meet it. It is a still heavier task to get prompt and fairly accurate estimates month by month of the condition of the important crops in every foreign nationality whose production or consumption affects the future export demand for our products, and the consequent tendency of prices. But the interests of agriculture and commerce require that *this work be done*, and *well done*, and DONE AT ONCE. And our national department is capable of doing it.

For example, a comprehensive table like the following would show where the wheat of the world lies, and where the demand for wheat exists, and how supply and demand stand related.

Table of production and consumption of wheat for 1881.

Countries.	Population.	Wheat consumed per capita.	Wheat used for bread.	Wheat used for seed.	Total wheat used.	Wheat produced in 1881.	Surplus above consumption.	Deficit below consumption.	Probable crop of 1882.
		Bush.							
United States	50,000,000	5	250,000,000	40,000,000	290,000,000	380,000,000	90,000,000	......	(?)
Great Britain	......	......	......	......	......	......	......	......	......
France	......	......	......	......	......	......	......	......	......
Germany	......	......	......	......	......	......	......	......	......
Austria	......	......	......	......	......	......	......	......	......
Russia	......	......	......	......	......	......	......	......	......

The figures given for the United States are simply approximate.

The last column would need to be reported monthly from May or June of each year till September. The other columns would need to be prepared for the *previous year*, each year in April or May to be ready for comparison with the monthly reports of the current year. This is but a rude plan of the foreign work now required of this department. Now, then, I say it is no light task thus to map, and bound, and lay one's hand upon the *wheat and the wheat-want of the world*, but our Commissioner *can do it with suitable aid from Congress*.

Our Signal Service, Argus-eyed, watches every cloud, current, wind, and storm; notes its center, its direction, its general direction and velocity and its violence; and then with an hundred times the hundred hands of the fabled Briareus of old mythology, it daily sends the facts over all our telegraphic lines, and posts its bulletins in every hamlet, to aid or warn and protect our navigation, our commerce, and our agriculture. *A similar service* is now imperatively demanded of this Agricultural Department in regard to the exact condition month by month, at least, of the wheat in all the important wheat-producing and wheat-consuming countries of the world. And, as no work is more necessary, so none can be more popular; not only with farmers and business men but with our legislators. And so the necessary aid from Congress will be promptly given, if only the work is once begun.

But while this foreign work can be done satisfactorily only by our national department, the minute and accurate township work necessary in the several States can, I am sure, be best done by the several State boards of agriculture, and the main results and totals be telegraphed at once to Washington for immediate tabulation and wide publication through the Associated Press. Fuller results by mail could be given in the monthly pamphlet reports of States and nation. We, as States, can thus be the hands and eyes, while the national department shall be the head to arrange and the tongue to give forth the facts.

The advantages of this State system, I think, are many and important.

First. *Gain in time.* If individual correspondents report directly to Washington by mail, say the first of each month, then reports from by-stations in Colorado, California, and Oregon will be ten days in reaching Washington; but if the correspondents of each State report direct to their own secretary or commissioner of agriculture, then the condensation of a thousand reports can be made in a single day and night *for all the crops*, and a clear gain of a full week be made. We have *no right* to use the mails when all the heavy dealers use the telegraph. The loss of a week's time here may be the loss of millions of money to the farmers of our land. Still further loss of time would occur in the condensation of so many *individual reports* in Washington, instead of having condensed summaries from our own inland States and from foreign countries.

Second. *Personal knowledge and supervision.* In this respect the State secretary of agriculture has every advantage over the national Commissioner. The latter can by no possibility know the general condition of the whole country *by* personal inspection. The area is too immense. But for a single State this is quite possible. For example, in Ohio. Our board of agriculture manages the State fair, inspects fertilizers, and reports the crops in summer, and with the aid of our agricultural college conducts farmers' institutes in winter. In short, it has charge of the agricultural interests of the State, except the purely educational, which belong to the college. This combined work requires the secretary to travel extensively, and often in all parts of the State, and gives him the best possible chance to see with his own eyes the condition of the crops, and judge of the correctness of the reports of correspondents. It also gives him an extensive acquaintance with the best class of farmers, and a chance to perfect his corps of crop correspondents. The advantages of this personal contact, acquaintance, and supervision cannot be overestimated.

Third. *Compensation.* No direct money compensation has yet been given to correspondents, either by the State or national departments. Indeed, there are grave doubts whether it would yet be possible or wise. But all our crop reports and other printed matter, including annual reports and State fair matter, are promptly mailed to all our correspondents. Also cards, or complimentaries, are sent, inviting all our correspondents to attend the entire week of our annual exhibition—State fair—and become acquainted with our president, secretary, and members. This acquaintance is fast being extended, both at the State fair and at farmers' institutes (held in some thirty counties annually), and is a great help in the statistical work, while it increases the attendance and even the cash receipts of the State fair. This last fact is respectfully commended to the attention of other State boards.

Fourth. *Minuteness and accuracy.* The fact is an important one that we have ten times as many correspondents on our lists as the national department can have for Ohio, and more than twenty times as many who actually report. This makes our May, June, and July *estimates* more reliable. Then again our methods can be, and I think are, more exact. Let me describe them very briefly. Through courtesy of our auditor and secretary of state we now have the assessors of personal property ascertain in May the exact acreage of the main cereals for the *coming harvest.* This is no guess-work, no percentage on last year's guess. It is an accurate enumeration of acres of the then growing crops, given by each farmer in every township while the facts are still freshly in mind. It has all the accuracy of the decennial census, and the plan is earnestly recommended to other States as a basis for accurate estimates.

This acreage by townships is tabulated in our office, and as soon as the thrashing begins neat pocket folders, or "thrashers' blanks" ruled, and with suitable headings for acres and total bushels thrashed, and with full directions, are mailed to all our correspondents, for each to give to two or three of the leading thrashers in each township to record daily the results of thrashing for three weeks and then report. To illustrate, I give the actual workings in one county. Sixteen townships in Licking County reported, as given in our August report, 8,912 *acres thrashed* (up to date, August 8), with a total yield of 139,678 *bushels.* Dividing we get, as the yield per acre, $15\frac{6}{10}$ bushels. But the total number of acres in the county is 46,298 and this multiplied by 15.6 gives a total for the county of 722,249 bushels. Similar reports and computations for the other counties gave 38,010,057 as the total for the State. The results of five weeks more thrashing reduced the estimate to above 37,000,000, against 52,600,000, our estimate for 1880, which was probably as nearly a correct estimate as it is possible to make, viz., the exact results of eight weeks' thrashing; more accurate I believe than that made by the assessor the next spring after the farmers have largely forgotten *what their crops really were.*

These reports and similar ones from neighboring States where similar statistical work is done, showed by August, and even by July, that there was sure to be a heavy shortage in wheat, apples, and potatoes. And as the reports were widely circulated, and the main points were widely telegraphed by the Associated Press, and published in most of the daily and weekly papers, the farmers *held for* the sure advance, and got from $1.25 to $1.45 instead of 90 cents for their wheat. And so several million dollars were probably saved to the farmers of Ohio, in the sale of their wheat, apples, and potatoes, for in a few counties apples were a good crop.

These reports, if made national by counties, will show producers, consumers, dealers, shippers, and railways where the local abundance lies, and thus facilitate distribution of products and equalization of prices, and prevent waste of products in places of local abundance.

I believe the system of collecting statistics thus is more prompt and accurate, as I have said, than the national department can possibly make it by any centralized system with the individual correspondents all reporting directly to Washington. Certainly if we compare it with the work done under the last administration there can be no question. The rule "*De mortuis nil nisi bonum,*" "speak nothing but good of the dead," is a wise one; and I therefore regret that truth compels me to say that much of the statistical work of this department under the last Commissioner was worse than worthless. Take a few examples at random from the last two reports, August and September; before the present able statistician had been appointed, and before the present Commissioner had taken hold of the work. The August report says (pages 14 and 15), "The condition of the potato crop, August 1, was 92 against 98 at the same date last year," and the September report gave it as 86. And this in the face of the fact that it was then known in all the main potato regions that the potato crop was *scarcely more than* 25 *per cent.* of the year before, in fact was, perhaps, the most *disastrous failure* for a decade. And so in a few weeks from the time this department had sagely stated that we had 92 per cent. of a full crop, the anomalous fact stared us in the face that we were *importing potatoes from abroad*, and that they were selling in our cities by the car-load on track for $1.20 per bushel, and retailing at 35 cents to 45 cents per peck.

Again this department quoted apples in August at 70 per cent., and in September 66 per cent. of a full crop, instead of 25 per cent. or less, as was true. And to-day good apples retail in most of our cities at $4 per barrel and 50 cents per peck. Spring wheat is given as 82 per cent. in Ohio, whereas *no spring wheat is raised* in the State. In September, reports from only ten counties in Ohio are given, and yet on this ridiculously inadequate data the winter wheat average of the State is based. The Illinois wheat is given at 60 per cent., whereas it was then definitely known to the State secretary of agriculture that it could not exceed 35 per cent. And this gives an over-estimate of 14,000,000 bushels in a single State. And the facts now show that that State will have scarcely 4,000,000 of good wheat to sell, above seed and bread for her own people, against 40,000,000 to export the year before.

These are but a few of many facts that prove the figures and estimates to have been utterly unreliable—prove that this department failed to discover *wide-spread failure and disaster* in a whole State, and even in the whole country. Such reports are an outrage, a disgrace, and a great damage, and brought contempt upon an administration that was wasting its strength on tea that would sell at nineteen cents per pound, and on molasses that cost a hundred or a thousand dollars a barrel, and neglecting these important statistics of our heaviest products.

How shall the present Commissioner and his able statistician redeem the statistical department from odium and restore its credit? In all cordiality I say, in no way so surely as by accepting the hearty co-operation now freely offered by the great grain States of the West, where efficient systems of monthly reports are in existence, or to be begun the coming spring.

One fatal mistake of the last Commissioner was that he cut loose from the sympathy, co-operation, and advice of those officially in charge of the interests of agriculture—boards of agriculture, agricultural colleges, and agricultural papers. The present convention is one of many proofs that his able successor is pursuing and will continue to pursue exactly the opposite course. If he shall only succeed in establishing a system by means of which all the people shall know promptly and accurately, month by month, *the condition of the grain crops of the world*, he will have accomplished a great and valuable work. And I believe Congress should not hesitate to make all reasonable

and necessary appropriations for carrying forward a work so essential to our national prosperity.

The PRESIDENT (Dr. LORING). The convention will pardon me at this time, if I make a remark or two with regard to the paper just read—a paper which I consider literally crowded from the very beginning with valuable information. I don't think that I have ever listened to a more substantial and valuable essay on any public occasion. No one more appreciates the value that the statistics of the country have bestowed upon the agricultural popualtion of this country, than I do. Their value has become incalculable, and so important that the business of the country cannot get along without them.

Prompt and accurate information of our improved methods of transportation, improved processes in manufacture and all industrial pursuits secured in every section of the country, should be laid before our people. The accurate farmers of to-day are just as much interested in the statistical conditions of the manufactures of the world as were Boston, New York, or Philadelphia fifty years ago; and I believe it is as manifest to this convention as it is to me, that they are entitled to it, not as the results of voluntary contribution, but from the results of true, carefully compiled information, from a duly constituted and regularly compensated labor, paid for by the general government itself. [Applause.] Now, I have not been in the habit of criticising our public servants. Somehow I have always had unbounded faith in them as a rule. It has always seemed to me that every government official, every man in Congress, every governor, every man clothed with authority of whatever nature, must of necessity hold himself to that responsibility due to his position; but I have been peculiarly impressed with certain defects in relation to the management of certain branches of government, which Mr. Chamberlain has referred to.

My attention was early called to the statistical bureau of this department. Of course, I turned my eye, in the first place, to the recorded reports of my own State, because I naturally felt more or less familiar with the several counties reporting. I found to my astonishment in the statistical report of last June that in Berkshire County the average of grain growing had increased, but in Suffolk County it had diminished. Now Berkshire County is one of the western counties of the State, where the production of grain is always large; and Suffolk County, where, as the report says, the production of grain was limited on account of the overabundance of water, is the city of Boston and the harbor. [Laughter.] I remember reading an incident which was reported some time ago, to the effect that on a certain date a flock of wild geese flew over the town of Rowley. Rowley is a small town lying on the seaboard, and is so situated that wild geese in their migratory passage must of necessity fly over it; but I must confess that I have yet to see the necessity of making a record of the flight. [Laughter.] Now, it seems to me that accurate and important statistics have become one of the objects of popular demand, and their publication a necessity of the day.

On the 19th of last August I had the honor of presenting to an assemblage, at the opening of the Manufacturers and Mechanics' Institute in Boston, a statement in historical detail of the remarkable growth of the manufacturing industries of the country for the past fifty years. The manufacturers listened with the deepest interest and surprise; and I am sure that the effect has been to give a new impetus to the manufacturing enterprises, whose marvelous history I portrayed.

At agricultural conventions and twice at Atlanta the past autumn, I have endeavored to present such accurate statistical tables to my audiences as should give them some measure of comprehension of the enormous progress we are making as an industrial people; and everywhere they have been received with profound attention and interest. The more they heard the more they desired to know; and I have always found that the great stimulus of enterprise has been derived from a knowledge of what enterprise has done and is doing. I have been so impressed with this idea that I have in my own mind pursued exactly the train of thought laid before you this afternoon. I have been endeavoring to ascertain to my own satisfaction the way in which this department, as representing the greatest industry in this country, could avail itself of the most thorough and accurate facts. Now, I am not sure that voluntary contributions are always safe, however faithful and conscientious the correspondent may be. I know there can be, in each State, an organization of such a description that the information it secures may be reliable and that part of that information may be voluntary. But the main facts, the underlying system of collection, and the conclusions deduced therefrom must be secured by proper officers in the employ of the government itself. The amount of money necessary for this would be by no means large, and where properly used could be made of great service.

We have in the State of Massachusetts a system of this description managed by an accomplished statistician, the Hon. Carroll D. Wright, who is head of our bureau of statistics and labor, and every one there understands that the statements which he makes with regard to the statistics of that State are thoroughly and absolutely reliable. His official corps is small and the expenses of his office are light, but his work is invaluable and complete. On the question of labor I obtained from him and from the Census Bureau under this government a vast amount of valuable statistics and facts to submit to the manufacturers and mechanics of New England last autumn. Now I think there can be a union between this department and the State bureaus for statistical purposes—a valuable, reliable, and important union. So convinced have I become of this that I have already presented an estimate to Congress for ten times the sum usually asked for for this work. Usually there has been appropriated $10,000 to the statistical branch of the department. But I trust this matter may be presented to Congress in such a strong light that there will be no hesitation in increasing this insufficient sum. In the estimate I made for the succeeding fiscal year I have asked for $100,000. [Applause.] Whenever I shall be called to go before the Committee on Agriculture to explain this estimate, I shall feel that I am strengthened by Mr. Chamberlain's paper to which we have just listened. It has convinced me, and I trust it has convinced every member of this convention, that the statistician of this department can put himself in immediate communication with the statistician in each State of this Union where there is one. There is no reason why statistical information should be collected for this department and paid for by the State of Ohio, for instance. On the contrary, there is every reason why the general government should employ persons in Ohio to furnish facts and figures that will be of use to the whole country, and while the statsitical branch of this department in securing all those commercial facts to which the paper has alluded, and all facts relating to foreign crops and commerce, a proper combination between the States themselves and this department will secure all the rest of the information we so desire.

Let me add that the census returns of the industries made every decade are unequal to the wants of the country. The whole industrial population of the country will grow old and pass away in but little more than that time, and a new generation will come in, and set itself to work. The growth is so enormous that it is impossible to appreciate the increase from one decade to another. For instance, I am told in the statistical returns for 1870 that the corn crop was 750,000,000 bushels. I go struggling on ten years, and all at once day dawns. I look at the figures and behold! it has increased to 1,750,000,000. In 1870, I am told that the wheat crop (as I told you the other day) was 240,000,000 bushels. I am told by the census of 1880 it has increased to more than 450,000,000 bushels. Now, why should I wait ten years for this information? With one-quarter part of the expense which it takes to secure these figures every ten years, a flood of information can be poured out to the farmers of this country every year, which in its value would be almost incalculable. [Applause.] This can be done by the simple organization of a proper statistical bureau, which shall furnish a careful estimate of foreign crops and foreign commerce, and which shall put itself in communication with intelligent parties in the various States, who know what is going on about them. Statistical estimates secured in this way would be valuable and important, and I would present to this country, through such a bureau, an accurate statement each year with regard to the manufactures and other industries that are making us so rich and so powerful as time goes on. I am unwilling to wait ten years to know how much the cotton spindles in this country have increased; I am unwilling to wait ten years to know what the freights and fares of our railroads are; I desire that the people of this country shall know year by year the exact facts in order that we may understand what our rights, our wrongs, and our duties are; for when this knowledge is based on accurate information we know exactly where we are as a powerful, enlightened, and prosperous people. [Applause.] I am aware that the enumeration of the population may properly be taken every ten years. This enumeration of the people of this country in its various States and districts is a matter of the greatest importance and should be accurate, both for the purpose of dividing the country into Congressional districts, and that we may comprehend our educational, labor, and industrial systems in all the arts of life. Therefore let us have a census made up every ten years of the increase of our population, and then let us have an annual enumeration of the growth of our industries, so that the growing population may know what to depend upon; that the grower of corn, and of wheat, that those who are interested in the great industry of this land—the animal industry—horses, cattle, sheep, swine, wool, hides, leather, bones, and the rest, may know exactly where they stand. Now, I have made this statement because it grew naturally out of the paper just read, and I desire to express my gratitude to the gentleman from Ohio [Mr. Chamberlain] for furnishing me with an unanswerable argument with which I can support myself in my modest demand for $100,000 to put this department upon a good statistical foundation, preliminary to that time when it will be placed on a broader foundation where it will represent the statistical, the agricultural, and the mechanical industries of this country accurately and well. [Applause.]

Mr. GILLHAM said: In view of the admirable paper of the gentleman from Ohio, and the great amount of information it contains, which this convention has so much enjoyed, I desire to offer the following preamble and resolutions:

Whereas it is a matter of great importance to the agricultural interests of this country to have full and accurate statistics of the agricultural productions of the United States and foreign countries promptly published, in order to enable all interested to determine the tendency of prices and the probable demand for our surplus productions: Therefore be it—

Resolved, 1st. That this convention request the Congress of the United States, now in session, to provide by law for the collection, through the foreign service of this government, of the agricultural and commercial statistics of other nations.

Resolved, 2d. That the United States Department of Agriculture, and the several States and Territories, through their boards of agriculture or otherwise, be, and they are hereby, requested to co-operate in the work of collecting and publishing full, prompt, and accurate statistics relating to the agricultural productions of the United States.

Resolved, 3d. That the chairman of this convention, the honorable Commissioner of Agriculture of the United States, be, and is hereby, requested to furnish the President of the Senate and the Speaker of the House of Representatives, each, with a copy of the foregoing preamble and resolutions, and urge the passage of a law by Congress providing for the collection of agricultural and commercial statistics of other nations.

The resolutions were on motion adopted.

Mr. CHANEY spoke of the importance of our having foreign crop statistics. In the year 1878 we had an immense wheat crop in this and other of our winter-wheat growing States. The idea had been promulgated by the papers and politicians that there was an overproduction. Buyers, therefore, offered low prices. We regarded England, therefore, as our main purchaser of wheat, notwithstanding all the large requirements of the continent. The result was that the farmers sold out the stock of wheat in several counties in Ohio at 80 cents a bushel. He was a buyer and a miller, and paid as close attention to the market as any one, and when no reports whatever of the shortage of the continent was received we were without information of the condition of the market. The continental buyers came in and bought their supply in a short time. The result was that our wheat sprang up in value from 80 to 95 cents a bushel in a short period. Our buyers and dealers did not know the cause. The French buyers again left the market, and it dropped down to 80 again. The buyers here had only had the information they received through this department officially, and they bought accordingly.

It was believed that we had an immense crop—far beyond what we really had. What we want is to be posted every way as to the prospects of the crop of continental Europe.

The PRESIDENT. Mr. Blue will now present a paper on the history and value of agricultural statistics in Canada.

Mr. BLUE. Mr. CHAIRMAN AND GENTLEMEN: I may remark that I had no intention of reading a paper to this convention when I left home. The paper I have is really a government report, and is, in a measure, confidential. Some of the delegates have, however, urged me to read such portions of it as shall not violate this confidence, which are the portions relating to the value and history of agricultural statistics. Before passing to the reading of the proof-slips which the printer handed me the evening before I left home, I want to say that I think it would be a good idea if there could be established an international crop system on this continent, especially between the United States and Canada—as we have already an international Signal Service—and one is just as important as the other and will become more and more so every year.

The province of Ontario is now the chief grain-growing province of the Dominion, but the time will soon come when the Northwest will not only be the first grain-producing section of Canada, but also of the continent. There is the *habitat* of spring wheat. In no other part of the world does spring wheat attain such perfection as in the Canadian northwest, where there is an area of 150,000,000 of acres, every acre of which is well calculated to grow spring wheat. This country is being opened up very rapidly. During the past year a great many emigrants have settled there, and I think it very desirable that we should have an international crop-reporting system between the United States and Canada.

AGRICULTURAL STATISTICS: THEIR VALUE AND THEIR HISTORY.

The husbandry of the past fifty years is a record of marvelous progress, both in methods and results. Intelligent farming is no longer confined to a score of men in a country, or one man in a county. We see the evidence of it on every side—in the use of labor-saving implements, in the increase of improved breeds of live-stock, in the drainage of the soil, in the rotation of crops, in the application of fertilizers, in the development of the dairy system, and in the great diversity of products of the field, orchard, and garden. There has been a steady and general leveling upwards.

Throughout this period governments have taken a keener interest than ever before in agricultural affairs. In every country of Europe, with, I believe, the single exception of Turkey, there is a ministry, bureau, or sub-department of agriculture, with an organized system for conducting inquiry and reporting facts in all matters affecting the interests of the farmer. The same thing is true of the United States, as well as a number of individual States, and also of my own country, though in a less degree.

By encouraging exhibitions, collecting and publishing valuable information, introducing new breeds of live-stock or new varieties of grain, fruit, and seeds, taking measures to check the ravages of disease upon animal or plant life, and establishing colleges and experimental farms for the special education of farmer's sons, governments have done much to aid and direct the operations of the husbandman, and to give him larger profits for the fruit of his labor.

No one seriously doubts the utility of correct information on the supply of food, to town and country, to rich and poor, to farmers and merchants. It enters largely into the commercial combinations of every year, and is one of the chief elements affecting circulation.

This is a field in which governments have almost exclusively the means of making an extensive series of observations, and perhaps no greater service could be rendered to the farmers and business men of the provinces of the Dominion and the States of the Union than to collect reliable statistics of their agricultural wealth from year to year.

THE VALUE OF STATISTICS.

The value of statistics is apparent in this, that it is mainly through the pursuit of statistical inquiries we can be assured of real advance in the knowledge of human interests. The statist aims at discovering the actual condition of his country and the causes of that condition, with a view to discover also the methods of improving it.

By the aid of statistics just data are supplied to guide the exertions of the philanthropist, the judgment of the legislator, and the speculations of the reasoner. Facts unimportant in themselves, as George Lewis has observed, become important as units comprised in a complete enumeration, and results are thus obtained to which mere conjecture, or the loose and vague impressions derived from a partial observation could not have led.

Figures give definiteness and precision to ideas. With regard to questions of drainage, ventilation, food, and the use or abuse of strong drinks, it is the statistical information supplied on a large scale which alone can be conclusive. It is the essence of statistical inquiry that by dealing with masses it eliminates individual peculiarities.

Statistics of the census, post-office, customs and excise, and the courts give to us collectively the social and economic history of the age in which we live. They prove that there is uniformity in all human affairs, and there is permanence and steadiness in the laws which regulate our existence. From statistics history borrows a considerable portion of her light, to general public law they contribute most valuable materials, and they enrich politics with a multitude of practical data.

A report showing the actual territorial wealth of the country, the different branches of its produce and the mean returns which they afford, would be invaluable to the economist and the legislator. By proving numerically the happy effects of any measure of economic legislation the trustees of power would be taught the superiority which may be acquired by the prompt imitation of nations most advanced in agriculture and manufactures, and in the manual perfection of the arts and trades. Government has an interest in the enlightenment of laborers, whether agricultural or mechanical, for they are the real producers of wealth. It is its duty to do for them collectively what they have no means of doing individually, or even by organized association.

The value of information depends on its accuracy. An annual record of trustworthy facts, setting forth the productive power and value of both land and labor when employed to the best advantage, could not fail to produce a healthy, stimulating effect. The influence of thousands of good examples would tell powerfully in favor of advancement all along the line. The counting of cows, a distinguished English agriculturist has remarked, is the first step towards their universal improvement—especially should the count give their annual product of butter and cheese.

Our farmers have great advantages for the economical production of beef and pork, mutton and wool, and it will render them a valuable service to obtain correct information of all discoveries and improvements either in the growing and feeding of domestic animals or in the curing of provisions; also as to the number of animals fattening in the country, and the probable demand for them in the home and foreign markets.

The profit is in the last few extra pounds of meat or cheese or butter, as well as in the extra bushels of wheat, corn, or barley. How to produce this extra is a question of vital moment to every farmer, and to the whole country. If by an improved system of tillage, or the use of fertilizers, the average wheat product of the country can be increased by one bushel per acre, the aggregate gain will be very great. On the area in Ontario, as given by the census of 1871, it would be nearly a million and a half of bushels.

In one of his letters to Sir John Sinclair, Washington says that when he entered the public service in the Revolutionary war his flock of 1,000 sheep clipped 5 pounds per fleece; when he returned to his estate at the close of the war he found his flock so degenerated, under the care of a foreman of the old school, that the average clip was only 2½ pounds, then, as it is now, the average yield of the Virginia sheep. In Ontario, according to the census of 1871, the average was 4½ pounds, but we have many flocks of long-wooled sheep that yield as high as 8 and even 10 pounds. A fair average, with intelligent care in feeding and breeding, should not fall below 6 pounds, and this on the sheep census of 1871 would give us an extra 3,000,000 pounds for the whole province, or an annual addition of $1,000,000 to its wealth by wool alone.

The great defect in our agriculture is the failure to rear the proper number and quality of animals. If the quantity of live stock were doubled the aggregate of grain produced might also be greatly increased, without any corresponding increase in expense. But there is danger in running to extremes; the farmer must seek to avoid over-production.

At present, industrial facts are ascertained for us by the census, which is taken only once in ten years. But the whole condition of agriculture may change in that period, so that at best the information of the census can be only a subject of curious interest to the farmer; it will not help him to decide what he fairly ought to get for his grain and live-stock, and whether to sell or to hold; it is gathered and published at too wide intervals of time for practical usefulness or guidance.

Agricultural journals and the daily and weekly newspapers are doing invaluable service to the country, but they cannot work under an organized system, nor cover the whole ground of inquiry. The experience of the ablest and best conducted journals of England, the United States, and our own country is that, with the most painstaking effort, the collection of statistics and reports is fragmentary and unsatisfying. Governments alone can do the work efficiently and continuously.

Every farmer knows that the price of his products is regulated by the law of supply and demand. Prices naturally tend to the equilibrium found under this law, and for a high price obtained under a false impression of scarcity the producer pays the penalty through prices running to the other extreme.

The grain-dealer or the speculator on the corn exchange, with a longer purse and better means of information than the isolated farmer, can learn the probable yield of crops sooner than any one else, and may sweep the markets before prices have moved

But if statistics were furnished by the government every one would be as well supplied with information as the dealer or the speculator on the exchange. Hence the value of authentic reports on the condition of crops throughout the country and the world.

The misrepresentation of crop reports—which is a common device of speculators—is hurtful to the farmers, who are for this reason deeply interested in having trustworthy information. They have the earliest command of the market, and may take advantage of that position if they have the means of accurately anticipating the course of prices. It is no gain to the consumers that dealers or speculators have bought in a low market. They must pay the figure as fixed by supply and demand, and the lion's share of profits is seized by the middleman. Accurate statistics and reports, affecting the commercial dealings in farm stocks, would enable the producer to get a more equable distribution of profits, and to steadily increase his productive capital. At the same time they would aid the dealers who do a fair and legitimate business; it is the gamblers on the great corn exchanges who work mischief to farmers and to the trade.

A few illustrations of the practical use and value of crop reports as collected in an imperfect way by the bureau at Washington may prove instructive and interesting.

The corn crop of the Union for 1873 was injured by the fall frosts to the estimated extent of 135,000,000 bushels. When this fact became known through the monthly report of the Agricultural Department an advance of 20 cents per bushel was established, and the farmers reaped the benefit of it. The October report for the same year showed a decrease in the hog supply, and the market for hogs likewise improved immediately.

In the January report for 1873 the secretary of the Agricultural Association for Perry County, Indiana, writes:

"About the time of the potato harvest this fall (1872), our producers were all astray respecting the market value of the potato crop—one of our main crops in this section. This uncertainty was taken advantage of by buyers, and they swarmed down on our producers early in the day, offering 50 cents per bushel. Some accepted the offer, but the vast proportion of our farmers concluded, at the request of the association, to await the report from the Agricultural Department. It reached us in proper time, and a careful analysis was made of its reports of the potato crop. Our people acted on it, and the result was a gain of many thousands."

The low price at which the few sold was no gain to the consumer, and the high price was no loss. Under any circumstances he was bound to pay the price fixed by the demand, and the speculator only failed to make large gains through the producer refusing to sell at his offer. By waiting and taking counsel of the reports the farmers themselves got the benefit of the good prices, and it is a sound maxim that the profit should go to the men who earn it.

But the work of the bureau at Washington is too imperfect to foil the designs of the speculator, or to correct the misrepresentation of crop reports so as adequately to protect the producer against loss. In the first place, the number of correspondents is limited—there being only four thousand for the whole Union, or an average of two for every three counties; and in the second place, the reports are not issued with sufficient promptness. The consequence is that the speculator is given a margin of time for his work.

It is a well-known fact that an assumed or a reported scarcity has at first the same effect on prices as a real one has. The rise is just as rapid, the fluctuations just as violent, and the final result more disastrous. What occurred in 1879 will show how the game of the speculator is played.

As early as the 1st of July the heavy grain-buying firms of New York and Chicago knew that the wheat crop was abundant in their own country, that it was a failure in Great Britain and some of the European states, and consequently that the export demand would be very great. They had experienced men moving about in the country getting accurate information, and local buyers who made regular reports on the state of the crops. Upon the facts collected in this way, and which were sacredly treasured in their own offices, the grain kings formed their judgment; they gave to the public only what served their own ends. The fact that there was a large foreign demand they either suppressed or denied, and the fact that there was an unusually large crop in their own country they brought out with emphasis. If the farmers were as well informed as the leading buyers they would have held on for an advance; but they were not, and before the issue of the Washington report a great portion of the winter wheat south of the latitude of Chicago was disposed of at 90 cents per bushel. The price then quickly rose to $1.20 per bushel, and the farmers of the spring wheat belt were paid about $1.30. The wide margin of profit on early sales, which should have gone to the farmer had prompt information been given by the bureau, was swept by the New York and Chicago dealers as their winnings in the game.

Large quantities of the wheat in store were disposed of at a fair market price, but the more reckless speculators resolved on another move. They determined to force up the price of wheat by pointing to the great foreign demand, and declaring that the home crop had been largely over-estimated. But this stratagem had no effect on English buyers. They had the carefully-collected crop reports of their own country, of the wheat-growing countries of the continent, of the Australian colonies, and of the bureau at Washington, and they knew that the wheat supply of the world was ample for the wants of the year. They bought wheat everywhere but in New York and Chicago, and the result was that in a few weeks the American ring was broken. The speculators were not strong enough to carry their load; but, besides the serious fall in prices, their collapse came very near to precipitating a commercial crisis. Early, accurate, and generally diffused information as to the state of the crops at home and abroad would frustrate all such attempts of the grain speculators to "bull" or "bear" the market.

Another instructive lesson is furnished by the crop and stock reports of Ohio. The wheat crop in that State last year was [illegible], and had it been equally good all over the country the price would probably not [illegible] gone above $1.20 in Chicago. But the reports for Illinois, Iowa, and Michigan—the only other winter-wheat States that have adopted the plan of monthly crop reports—indicated that for those States the yield would be less than half that of the previous year. This information was promptly given to the press of the whole country, and advance sheets of the most important points and conclusions from each month's report were sent out in the same way. The Ohio report for October says:

"Farmers read the facts in many papers and on every hand, and the whole community came to believe and know that at least the wheat and corn crops of 1881 were really short, and that prices must rule high; and, as a rule, the farmers held and realized the profits that legitimately belonged to them. And so this information thus gathered by the State boards of our own and a few other States, and thus widely published, has, in the opinion of judicious men who are acquainted with the facts before and since this work was begun, been worth more than $10,000,000 to the farmers of Ohio alone. For that sum would be less than 30 cents a bushel on this year's crop, and that 30 cents (or $10,000,000) would have gone largely into the hands of speculators but for this prompt and reliable information in the hands of the farmers and of the public generally. Indeed such was really the case with the crop of 1879, before this crop report work was begun by any State except Illinois."

Owing to the long-continued drought last year the bean crop was short in Ontario, and also in New York and Michigan. This was known to dealers early in the season, and before the crop was fully harvested a great portion of it was secured by their agents at prices ranging from $1.25 to $1.60 per bushel. A few weeks later it was quoted in the Detroit and Montreal markets at $3 per bushel, and the lumbermen of Michigan and the Ottawa Valley who had delayed the purchase of supplies were obliged to pay outside figures to the speculators, who were thus well rewarded for the cost of early information. Under an efficient system of collecting and publishing crop reports this advantage would have gone to the producers.

These illustrations will suffice to make clear the practical value of statistics and reports, both to the producers and the consumers of food. Other uses which they would serve I need only indicate.

They would encourage the keeping of farm accounts—necessary in order to make fairly accurate returns.

They would direct the purchasers of live stock to the sections in which supplies may be most easily obtained.

They would give a basis of certainty upon which to compute the country's annual surplus of products, or its requirements.

They would serve to prevent panic and sudden and unnecessary fluctuations in prices.

They would, by showing the probable extent of employment in the carrying trade, enable the shipping and railway interests to make timely provision for it.

They would mark the tendency to over-crop, and, consequently, to impoverish the soil, and demonstrate the value of fertilizers and the importance of a reform in tillage.

And lastly, they would note the resources of the country, its capabilities and its progress in material wealth, and so serve to attract population and capital from other lands.

To ascertain the present state of the country, to compare different places at the same time, and the same place at different times, are objects of great interest to every citizen.

THEIR HISTORY.

Having considered the uses and purposes of agricultural statistics, I propose in the next place to treat of the subject briefly in its historical aspect. This is desirable in order to show what other countries have done, and to learn what their experience teaches.

In Great Britain statistics of every kind have made slow progress. It took nearly half a century to carry a measure in Parliament for taking the census of the nation, the first bill having been introduced in 1753, and the first census taken in 1801. The various published statistics consisted for many years of returns to Parliament presented without regularity or order, and it was not until 1832 that a statistical department was created at the Board of Trade, with the object of arranging and systematizing publications and returns. Since that year statistical offices have been created in connection with other departments; but various reforms have been made in the conduct of the work, and a royal commission, appointed in 1877, has been engaged for four years in an effort to simplify and systematize the whole body of statistical returns. Their report, which is exhaustive and valuable, now awaits the action of the government.

In England it required the lifetime of a generation to remove the prejudices of the farmers against the collection of agricultural statistics. They feared that the scheme had something to do with local rates or the national taxation, or that it was a device of landlords to learn their true condition and raise the rents.

In 1836 Mr. Poulett Thompson, president of the Board of Trade, conceived the idea of collecting information through the clergy, but prudently resolved to test his plan at first in one county. Printed forms were prepared asking for returns of the whole land—wood, waste, and under cultivation; the acreage and yield of the different crops; the number of each kind of live-stock, and the average rate of wages. These were sent to the clergymen of 126 parishes in the county of Bedford, but the result was so unsatisfactory that the plan was abandoned as hopeless; only 27 of the 126 clergymen made any return.

Various other experiments were subsequently made, and the subject was taken up in Parliament. From 1845 to 1864 bills and resolutions were introduced and discussed session after session, and a score of schemes were considered, only to be dropped or rejected.

In 1853 authority was granted by the government to conduct an experiment in two English counties by the poor law board, and in three Scottish counties by the Highland Agricultural Society, under a scheme prepared by its secretary; and in the following year the experiment was extended to eleven English and Welsh counties, and to the whole of Scotland. The making of returns was purely voluntary, but while in Scotland the extent of failure was less than one-fifth of one per cent. it was in England 7 per cent. The difference of results was attributed to the kinds of machinery employed; there was a strong prejudice against the poor law board, and the Highland Society was trusted as the farmers' friend.

No further effort was made at that time to collect statistics in England, but the work was continued in Scotland until interrupted by a dispute over patronage and the audit of accounts. The treasury asserted its right to name the collectors as servants of the government, and insisted upon all accounts passing through the board of audit. The secretary of the society refused either to yield the patronage or submit to an audit, and he settled the dispute by stopping the work.

The success of the experiment, however, proved the value of such statistics, and helped to remove the prejudice against them. Finally, in the session of 1864, a resolution was carried in the House of Commons affirming that the collection of agricultural statistics was desirable, and in June of the following year the president of the Board of Trade asked for and obtained a vote of £10,000 to enable him to effect the aim of the resolution.

In the same month the rinderpest made its first appearance in England and spread rapidly throughout the kingdom. A royal commission was appointed to consider its origin and nature, and after taking some evidence they wrote to the Board of Trade urging "the importance of obtaining correct information respecting the number of horned cattle and sheep in the country." The board concurred, expressing the opinion that if such information were obtained it could not fail at that time to be of great utility and interest to the agriculturists and to the public at large. Orders were forthwith given for the preparation and distribution of schedules, and it was expressly stated that "the number of live stock belonging to individual persons will not be divulged." The returns were made on the 5th of March, 1866, through the medium of officers of inland revenue, and the report was published on the 7th of May. It gave the number of cattle, sheep, and pigs in each county, the number of cattle that died or were killed on account of the plague up to the week ended 21st April, and also the percentage of losses.

This was the initiation of agricultural statistics in England and Wales, and, as already indicated, it had its immediate origin in the incidence of the rinderpest. The preventive measures to check the disease, and the scheme for compensation accorded to those whose cattle were sacrificed in order to save the stock of others, almost necessitated a cattle census. Its practical use was so apparent that the action of the Board of Trade met with ready approval, and when it was followed up in the same year by a request for the acreage returns a very friendly response was made. These returns when prepared and issued were largely circulated in the agricultural districts for the purpose of making known the information afforded by them, and also of showing that nothing was published which could in any way injure the interests of individual occupiers of land.

In this way the farmers of England became convinced that the collection of statistics was a matter of special interest to themselves, that it was not a device to increase rent or taxes, and that even its inquisitorial character was redeemed by a worthy object.

The information contained in the returns consists of the total area of land occupied; the acreage under each kind of crop, bare fallow, grass, and permanent pasture; the acreage under orchards, market gardens, nursery grounds, and woods; and the number of horses, cattle, sheep, and pigs.

The great number of occupiers and owners of land in Great Britain makes it necessary to have a large staff to collect those returns, and the officers of inland revenue have been selected for the work by the government, "as a convenient and efficient local agency to obtain the information with as little trouble as possible to the occupiers of land." It is the duty of these officers to distribute and collect the forms, and to tabulate them for the counties. The forms are issued to all occupiers of land—stamped for free transmission by post—and thus a ready means is afforded for their prompt return to the local officers. In cases where the returns are delayed or refused, the officers are required to collect them personally, or make estimates from their own observation, which is the cause of considerable delay in their reports to the Board of Trade.

The returns were at first collected on the 25th of June, but in 1877 the date was changed to the 4th of June, the object being to secure earlier publication. In that year the summary was issued on the 21st of August, instead of the middle of September as in previous years, and the complete tables and report at the end of September. Last year the summary was issued on the 15th of August, and the complete report on the 24th of September. It is also found that by the change to the earlier date in June the farmers have more leisure for filling up the schedules, and that some who flatly refused to do the work before, during the busier season, do so now readily.

In 1876 the acreage obtained by estimate in England—where farmers refused or neglected to make returns—was 2,178,515; last year it was only 1,584,228 out of a total of 32,211,512 returned, or 5 per cent. In Scotland last year the acreage estimated was only four-fifths of one per cent., and in Wales only one-tenth of one per cent.

In his report last year Mr. Giffen remarks that, especially in England, "the tone of the collectors as regards the disposition of farmers to make returns is in many districts more and more satisfactory every year, and on the whole there is a steady improvement." I need only add that in Great Britain the statistics are collected without legislative authority, and that the giving of information is purely voluntary; the duties of collectors alone are mandatory.

The average prices of agricultural produce in England are published weekly and annually in the London Gazette, as directed by acts of Parliament. The basis of the weekly average is a division of aggregate proceeds by aggregate quantities sold, compiled from all markets prescribed by the statutes, and the annual statement is made up from the weekly returns. The Scotch plan—the primary object of which is to fix the tithe commutation—is by means of an assessment jury summoned by the sheriff and examined on oath, whereby the value of grain not sold but used at home is included.

Ireland possesses a very complete system of agricultural statistics. It had its origin in the period of the potato famine, the first report covering the years 1847-'48, and its value was so clearly demonstrated at that critical time that it has been maintained ever since. Besides being thus commended by long use, the plan has been indorsed by the International Congress of Statisticans, who have adopted it as their own and recommended it to other countries.

The data of the returns are collected by members of the constabulary force, who visit each farm or holding to ascertain from the occupier or some other person connected with the farm the particulars required. This work is carried on under the superintendence of the registrar-general at Dublin, and his reports are made to the lord-lieutenant. An abstract is published at once and the detailed report is presented to Parliament. Briefly stated, the returns show:

1. The extent of tilled, untilled, and waste land, the number of holdings and their size in statute acres, and the number of stockholders and quantity of live stock—by poor law unions, baronies, counties, and provinces; and
2. The extent of land under crops and its value, the estimated produce of the crops, and the number of holdings exceeding one acre—by poor law unions, counties, and provinces.

There are also comparative statements under each of the above heads, embracing a period of ten years, the number of scutching mills in each county and province, tables of meteorological observations, and remarks on the probable cause to which the good or bad yield of the various crops in each district may be attributed.

The enumerators number about 3,400, but being in the regular service of the Government they receive no extra pay for the collection of statistics. The work is commenced on the 1st of June, and usually finished by the end of July. The names of the several parties from whom the particulars of tillage and live-stock are obtained are given in the returns, with a view to further inquiry should it be found necessary.

The abstract report of the registrar-general is prepared from summaries made by the enumerators, and is limited to showing the acreage under crops and the number and description of live-stock in each county and province. The estimated produce of the crops is reserved for the detailed report, based on information given to the enumerators by practical farmers and others qualified to form an opinion as to the yield in their respective districts.

The registrar-general bears testimony to the courtesy of all classes connected with the land in giving the information necessary for compiling the statistics, and to the zeal and efficiency with which the enumerators discharge their important duty.

In Belgium and Holland every kind of information connected with agriculture is collected under the superintendence of a body of gentlemen, usually proprietors of estates, who are elected for purposes of local government. Returns are made to these officers at certain periods by farmers or occupiers of land, and the result is every year the subject of a detailed report printed under authority of the governors of the provinces.

In France the ministry of agriculture collects monthly reports on the cereals in the agricultural districts and the result of the various crops, and compiles other special statistics—the number of live-stock, on silk-worm rearing, vine culture, &c. The local returns for the ministry are prepared by the *prefets* from the statements of statistical district committees.

Hungary, which is eminently an agricultural state, devotes great attention to the work. The product of the crops is collected yearly by means of inquiry forms, which are distributed to every parish and filled up by the parish magistrate, with the assistance of the most intelligent farmers. The forms are then collected, examined as to the correctness of their filling up by the statistical commission of the district, and sent in to the statistical bureau for the county and country summaries to be compiled and published. The data relating to vine culture and agricultural implements and machines are worked out in the same way as those of the crops product, with this exception, that the implement statistics are not collected annually, but at uncertain intervals when required.

In Austria and Austro-Hungary very full statistics of crops and live-stock are procured. In the latter country the statistics relating to the crops collected since 1869, and those relating to the annual increase of cattle, first published in 1875, are based upon estimates of the greatest possible accuracy and extent, "prepared by unprejudiced men well acquainted with the agricultural characteristics of the various Crown lands." These estimates, an official report states, "are preferable to figures worked up by men little acquainted with the subject, and possessing small skill in arithmetical manipulation." For the same reason the original inquiry forms are sent in to the bureau without any working out, experience proving that accuracy of statement and promptness in publishing the returns can only be secured when the actual first entries are laid before the figure critic. The information relating to crops is supplied by the agricultural unions, who prepare the facts for their own districts.

The states of the German Empire had their respective systems under the Zollverein, but in 1870 a commission of statists and administrative functionaries met to develop a uniform system. The work of the commission was not completed until the following year, when the Empire was established, and their report was made the basis of an Imperial system of statistics. It consists in the collecting and compiling of information furnished either exclusively by, or in co-operation with, the governments of separate states, according to special instructions from the Imperial authorities. The agricultural statistics of the Empire under this plan were first collected in 1878. They are given under three heads, viz: (1) Agricultural employment of the soil; (2) Proceeds of the harvest; and (3) Returns of live-stock, and are very elaborate.

The various other countries of Europe have their several systems, but those of Sweden and Denmark are the most complete, giving the acreage under crops and grass, estimated quantities of the crops produced, and the number of live-stock.

The present advanced state of agricultural statistics in the old world is largely due to the teachings and the influence of the International Statistical Congress. The resolutions of this learned body, adopted in 1877 at the meeting held in Buda-Pesth, are in substance as follows:

1. The governments of all countries to collect special meteorological observations in connection with agriculture, to be submitted to a central authority, elaborated, and published regularly.
2. To have regular monthly reports by special agents (crop reporters) on the state of cereal vegetation in their districts.
3. To secure observations regarding the influence of the destruction of forests and of replanting on climate.

4. To gather at as many points as possible in each country observations regarding storms, hail, and periodic phenomena relating to plants and animals; the result to be centralized, co-ordinated, and published.

5. To establish a certain number of meteorological observatories in connection with each other, the observations to be made known immediately to crop reporters, and a knowledge of them spread abroad to prevent the effects of frosts, inundations, &c.

Such a system, adopted and efficiently worked by the states and provinces of this continent, would render to the agriculturist an invaluable service.

In the Australian colonies good progress has been made. A conference of government statists, representing the colonies of Victoria, New South Wales, South Australia, and Tasmania, was held at Hobart Town in 1875, when resolutions were adopted covering the whole domain of social, industrial, commercial, and financial statistics.

The conference recommended in its report that the agricultural returns should embrace the area of land in occupation, the acreage and produce of crops, the weight of cereals and their market price, the number of hands employed and the rates of labor, the number of live stock, the number and value of agricultural implements, and the value of machine labor.

In its main features this was simply an adoption of the Victorian system. In Victoria there is an act called the local government act, which obliges all municipal bodies throughout the colony to collect such returns as the government statist, with the approval of the governor, in council, may direct, and all people are bound to give the information required to the municipal collectors under a penalty of £10. In this way the agricultural statistics are gathered without any expense to the government.

The forms are distributed to the local bodies by the official statist, and at a specified time the work of collecting begins. One schedule is filled up at each agricultural holding, and the proprietor signs his name to it as a guarantee that the collector has called on him and that the information is correct. The original returns are sent to the statist without being compiled, and they are classified in the statistical office according to the municipal districts in which they are gathered. Manufacturing returns are collected at the same time, and by the same agency.

There is no popular prejudice in the colony against giving the information, and consequently the penalty clause is seldom enforced. Every farmer has a guarantee that his schedule will not be used to his injury or discredit, for the collector is under a penalty not to divulge any information it contains, and the returns are only published in the aggregate by municipal districts.

As for the municipal bodies, they are subsidized by the government, and if they hesitate or refuse to collect the statistics the government has power to stop their subsidy. It has also power, if any local body does not send in the returns by the proper time, to appoint a collector to gather them and charge the cost to the delinquent body.

The legislature of Tasmania passed a measure for the collection of statistics in 1877, containing provisions similar to the Victoria act, and conferring like powers on the government statistician.

I need not in this convention refer to what has been accomplished in the United States. You are all familiar with the origin and progress of statistical work in connection with the Department of Agriculture since its organization twenty years ago. It is a work of great magnitude, extending over a wide aera and requiring for its proper direction a high order of executive ability. Indeed in view of its growing magnitude and importance, and no matter how ably directed, there is good reason for questioning the efficiency of the present system, as has been done in a very practical way by Illinois, Ohio, and two or three other States. It is evident that under State organization the field of inquiry can be more completely covered, and that more exact data can be collected; so that all that seems to be required now is an extension of the State movement and harmony of action between the State and national bureaus, such as we find under the new German system. In other words, you only require to develop the Federal idea in order to give your system a well rounded completeness.

A CONTINENTAL SYSTEM.

This leads me, in conclusion, to suggest the expediency of following the advice of the International Statistical Congress and organizing what, for lack of a better term, may be called the continental system. We have already such a system in connection with the Meteorological Service; stations are established throughout the United States and Canada; there is a daily interchange of reports between the head offices at Washington and Toronto, and daily bulletins are issued based on the total of information.

Now, why may not the two countries work out a continental system of crop reports in the same way? It only needs a mutual understanding and a prompt exchange of reports to give the idea practical effect.

But it may be said that the agricultural and animal products of Canada are not sufficiently important to make a factor in the calculation of the supply and demand problem. The same thing may be said of Ohio, Michigan, or Illinois as well as of Ontario or any other Province of the Dominion. Yet it does not follow that a knowledge of the products of one or other of those States is immaterial in making a forecast of the tendency of prices. The more extended and accurate our information the more reliable will be the advice we can give; so long, at any rate, as our surplus products continue to find a common market.

Besides, the time is not far distant when Canada must become a very important factor in estimating the food supply of the world. The Northwest is just beginning to be opened up, and in a few years its farm population will be numbered by the hundred thousand. It is a prairie region of vast extent. There are at least 150,000,000 acres of wheat and barley land and 50,000,000 acres of pasture land, a territory equal in extent to the States of Ohio, Indiana, Illinois, Missouri, Iowa, and Minnesota. It is the natural habitat of spring wheat, which attains there a perfection to be found nowhere else on the continent, and its grasses are so rich that cattle and horses turned out on the plains for the winter are taken up in the spring in prime condition.

The Canadian Northwest is a country of immense capabilities, and in any well-considered scheme of agricultural statistics its products cannot be left out of the reckoning.

A DELEGATE. I move that a vote of thanks be extended to Mr. Blue for his able and valuable statement with regard to crop statistics.

The motion was unanimously agreed to.

Mr. UPDEGRAFF spoke of the importance of the work which Mr. Chamberlain was doing in the State of Ohio, and the value thereof. He referred especially to Mr. Chamberlain's prediction that wheat would be worth $1.45, when at the time it was selling at 90 cents. Mr. Updegraff then referred to the difficulty which had always attended the granting of appropriations for the benefit of agriculturists as compared with those for the benefit of certain institutions, closing by advocating the sending of petitions to Congress by farmers requesting liberal appropriations for the Department of Agriculture.

Mr. CHANEY, of Ohio, explained that his State did not ask any appropriation from Congress, nor from anywhere else for its statistical work. That it simply asked that the general government should furnish the statistics for foreign countries, which his State has no power to collect, in order that it may acquaint its farmers with the exact state of affairs, thus helping them to reap the greatest advantage and the best prices from their productions.

Mr. BRIDGER, after some explanatory remarks in relation thereto, offered the following resolutions:

In pursuance of the French order that has just been received, dated February 18 last, forbidding the landing of American salt pork in France, which order was issued fallaciously and without foundation, in the opinion of this convention. For more than two hundred years the slaves of the South lived continuously on salt pork and corn bread, and performed an amount of labor annually that few people in this world have performed. In fact our Western empire has been opened by the men who ate more or less of the hog product from day to day: Therefore,

Resolved, That this convention petition Congress to pass a reprisal act that will forbid the landing of French wines, on the ground of adulteration, and exclude French silks on the ground that our cotton fabrics are forbidden, even under a tariff—with more than a hundred other articles of our production—whilst we receive everything produced in France under our tariff system that should be admitted into such a community as ours.

Resolved, That in our opinion every avenue of outlet for our surplus products should be most assiduously guarded. For example, France, until the last five years, was an exporter of wheat for seventeen consecutive years, and with three consecutive good crops in Europe, we may expect a decline in breadstuffs and provisions. On the basis of our present production,—therefore, the necessity of varying our crops as much as possible, and throwing a protection over our exports in every possible way, we recommend that the Secretary of the Treasury shall appoint expert inspectors of farm products at each of our important custom-houses, and upon his certificate only shall exports be made from the United States of breadstuffs and provisions especially, or such other articles as the Secretary of the Treasury may name. Said inspectors to furnish the government ample bonds, with the additional penalty of imprisonment for six months for every fraudulent certificate that may be issued.

Mr. CHAMBERLAIN. These resolutions have many points that demand more consideration than we can give them at this hurried hour, and I therefore move their reference to a committee of three, to be appointed by the chair, to be reported at some future time to this convention.

The motion was agreed to, and the following committee was appointed: Messrs. Chamberlain, Fisher, and Heron.

The president announced the papers for to-morrow, and then at 5.17 p. m., the convention adjourned until to-morrow at 10 o'clock a. m.

The convention was called to order at 11.10 a. m., Tuesday, January 17, and Mr. Sargent, of California, read the following paper:

VITICULTURE IN CALIFORNIA.

BY A. A. SARGENT.

MR. PRESIDENT: My esteemed friend, Hon. H. F. Page, of California, recently received a telegram from the president of the California Viticultural Society of his State, requesting him to lay before this body certain statistics concerning the important industry in which that society is engaged. As my friend is deeply engrossed in Congressional duties, he could ill spare the time to put those statistics in methodical form, or attend this convention. Last evening, therefore, he requested me to take this duty off his hands. To this I consented, well knowing, however, that I had not the time or data to do justice to the subject. There are some general facts and suggestions which I will submit upon the subject.

California extends along the Pacific coast seven hundred and fifty miles, with an average breadth of two hundred and thirty. Its area is 188,981 square miles. It is estimated to contain eighty-nine millions of acres capable of cultivation. To use a comparison, its agricultural area exceeds that of Great Britain and Ireland, or the entire peninsula of Italy. The soil and climate of the State are adapted to the growth of wheat, barley, oats, potatoes, hops, tobacco, hay, and sorghum; to corn, cotton, and sugar-cane; to every variety of garden vegetable cultivated east of the Rocky Mountains; to the apple, peach, pear, cherry, plum, apricot, nectarine, quince, fig, and grape; and along the southern coast the orange, lemon, citron, olive, pomegranate, filbert, walnut, almond, prune, pineapple, banana, cocoanut, and plantain. The strawberry is picked every month in the year, and all berries grow in abundance. The climate is free from severe frosts, cold, or storms. The tornadoes that trample through other portions of the country are unknown there. The climate is favorable to stock-raising, and sheep husbandry is an important interest. "The north side of a rail-fence" has no terrors or mischiefs for cattle, even in winter. The farmer needs no great barns or granaries to store his harvest; but leaves his wheat in sacks in the field until it can be conveniently removed for a market. With a variety of productions unexcelled on any equal area, a climate unsurpassed in beauty and salubrity, and a soil seemingly inexhaustible, it is easy to predict for the agriculturists of the State the highest prosperity and comfort.

Such is agricultural California as it is seen to-day. Thirty years ago it was looked upon as a hopelessly barren wilderness. The original idea entertained of California was that some parts of it might be fit for grazing; but it was considered as generally unadapted to agriculture. Mr. Webster, in a speech which made a sensation at the time, gave as a reason why the Wilmot proviso need not be extended to the territory out of which the State was subsequently formed, that slavery could never exist upon such barren soil; that nature had erected a more formidable barrier than legislation could devise. When gold was discovered at Sutter's Mill and found to glitter among the grass roots of the mountains, a vast population poured into the State by the weary plains, the long route around Cape Horn, and the sickly isthmus; but of all those moving columns of humanity, instinct with young life, enterprise, and hope, none dreamed of riches of soil of the golden State; none knew that the yellow harvests that would by and by beautify the State could be a possibility, or dreamed that the farmer's plow would turn up treasures far surpassing those developed by the miner's spade and pick.

It was early discovered that the wide plains over which listless cattle had roamed at will would respond to cultivation; and wheat production in time rivaled that of gold and silver. Then fruit trees and vines began to be cultivated, and nature laughed as it handed back abundant and luscious returns. The barren foot-hills, as they were called, needed only an invitation to show their capacities, especially for the vine. The yield of grapes were found to be almost phenomenal, wherever the vine was planted, from the Mexican border to Mount Shasta. No trellises were needed. The vine could sprawl upon the ground and never mildew. Leaf diseases were unknown. There were no unfavorable seasons; all soils seemed congenial. Few insects disturbed the vine or fruit, and phyloxera is to this day of slight moment.

With such abundance and perfection of raw material, the attention of the pioneers was at once turned to wine making. Rude wine presses were improvised, and everywhere there was anxiety to learn how to raise the raw products to the dignity and desirability of a marketable commodity. The results of the first experiments were certainly crude. Even the patriotic Californian, who is said to attest to the perfection of everything emanating from his State, was compelled to admit that unquestioned purity of materials could not compensate for equally unquestionable harshness—let us say fiery acidity. The soil was too generous. The burden of alcohol was too great, even to imitate the fruity wines of Spain and Italy not to mention the thin wines of France and Germany. Then the workers lack experience, and knowledge, and machinery, and method. In the expressive language of the prize-ring, California wine "got a black eye." It was the thing even in California to decry it; and elsewhere it was used only to give body to some detestable thin wines of doubtful parentage, which were then sold under foreign names. Wine making in California passed through all the phases that beset most new industries, where the promoters have zeal and perseverance and little knowledge. Those processes are familiar to you, and I need not dwell on them. Suffice it to say that many men abandoned the field, plowed up their vines, and turned their vineyards to more appreciated uses. But there were others who persevered. They imported the best varieties of vines; they experimented in modes of culture; in the effect of different soils; in results from selected grapes and in the mixtures of various kinds; they induced experienced workmen of France and Germany to come over, to apply the methods of those countries, and by enlightened and costly efforts all directed to the solution of their great problem, they have at last conquered the difficulties that arose from natural conditions and inexperience, and are even fast overcoming the still greater obstacles interposed by prejudice and skepticism.

The number of acres in California producing vines is over 50,000. But so great has been recent stimulus to the business that there have been planted within a twelvemonth 50,000 acres more, which will bear in four years. The acreage bids fair to increase immensely every year. The vineyardist finds as ready sale for his grapes, if he does not wish to turn them into wine, as the farmer does for his wheat, and at more remunerative prices per acre. The last vintage was over 9,000,000 gallons. The present value of the wine crop to producers is $3,000,000. That of table brandy and raisin grapes is $1,500,000. The world does not produce anywhere finer raisins than those of Fresno County, where once arid lands have been irrigated and subjected to raisin-grape culture.

The government collects annually fro m California brandy $800,000. The figures show the importance of this interest even in its comparative infancy. The possibilities for expansion are immeasurable. The viticulturists of California deem it reasonable that a part of the sum collected on their domestic product should be expended for experimental vintage in that State, where climatic conditions are peculiar. The government would undoubtedly render a vast service to this promising industry if it would set aside a part of the produce of this tax to conduct experiments upon the unsolved questions in connection with it. There is no field in the range of agricultural science that promises better returns.

The world has noticed with concern the ravages of the phyloxera in France. Great estates, once valuable for their rich vineyards, have been devastated as by a prairie fire. The desolation has been widespread, baffling the corrections attempted by science until the production of wine has been greatly lessened, and the gloomiest forebodings are felt for the future of this great industry in that country.

At this juncture, California steps forward as the France of America. Its capacity is unlimited, and its wines are approaching the excellence of its typical namesake. Its soil and climate will answer any demand on their resources; discipline is taming the fiery spirit of its wines, and uniting to their acknowledged purity the delicacy and subtleness of the best foreign productions. Hence, certain California wines are already beginning to make a reputation under their own brands, and are readily sold as such in home and Eastern markets, while a vast quantity of our wine is sent to the Eastern States, and there sold under foreign labels. It is estimated that California is now sending to the Atlantic States more wine than is imported from France. I venture to suggest that it would be better for the health of your people if it should exclude French wines entirely from the market.

In California the cheapest element that can enter into wine-making is the juice of the grape. Adulteration is comparatively costly. There is no temptation to use even beet juice; and logwood, and the long list of drugs and chemicals that a Bordeaux laboratory is furnished with, since grape production is beginning to become a tradition in France, would be too expensive to compete with the gushing juice of the wine-press in California. It is understood that the sophistication of wine is a regular trade in several of the seaports of France, which is carried on to a vast extent. Severe laws prohibit the sale of the infernal products in France; but their manufacture for export is not interfered with. The remainder of the world may be poisoned, but not France. This is a very proper measure for the protection of its own people by the authorities of that republic; but we may well take warning from it. The adulterators use any corks or labels that they please, and flood all civilization with detestable compounds that produce dropsies and Bright's disease and dyspepsia, and numerous other ills, that flesh loves not to be heir to. Against such villainous compounds, I put our pure California wines, our port and claret, as fine wines for domestic use as any imported from France, and incomparably superior to the mass of stuff sold as French wines. Our sparkling wines and our brandies are coming in for commendation by connoisseurs. I do not mention brands, because it is apart from my subject, which is merely to call attention to an interesting general industry. Large quantities of our port and claret are sold to you under foreign labels. You are fortunate that nothing is changed besides the label. Port that experts could hardly distinguish from old London dock, comes from our presses, and clarets equal to the old Chateau Lafitte has the same parentage.

It has always seemed strange to me that our people will more readily buy an article with a foreign name than as good, or one better, under a domestic name. In such matters we have not yet entirely achieved our independence. We have answered the sneer, "Who reads an American book?" And our historians, novelists and poets have forced the world's admiration. Our inventions won applause at the world's fairs of London, Paris, and Vienna. It is yet asked, "Who drinks an American wine?" But it is more feebly asked than formerly. California is working the miracle of converting the world from skepticism in this regard, and adding another to the great productive industries of the country.

The following papers and tables were submitted to accompany the foregoing essay:

[State Viticultural Commission, San Francisco district. Arpad Haraszthy, commissioner. Address, 530 Washington street, San Francisco, Cal.]

Hon. H. F. PAGE, Esq., *Washington, D. C.*:

DEAR SIR: I beg to inclose the documents on the analysis of foreign wines in the bonded warehouses of the United States at this ports. A circular was sent from the

Secretary of the Treasury to all the collectors of ports, requiring them to make reports upon the wines in bond, from whence imported, their qualities, their original and invoice prices, and have an analysis made of their various alcoholic strengths. Ex-collector Thomas Shannon requested me to assist him in the matter, and as no funds were furnished him for the analysis by the Treasury Department, that expense was assumed by the State Vinicultural Society, and the services of Dr. John I. Bleasdale were engaged for the purpose. Mr. Thomas Shannon made a complete and very lengthy report, which was forwarded to the Secretary of the Treasury. * * * I now wish to draw your attention to a few points comprised in the subjoined tables.

Clarets.—The *original* natural average alcoholic strength of the ordinary shipping clarets of France are under 10 per cent., and it can safely be estimated that all wines of ordinary character, showing more than 10 per cent. in these tables, have been fortified with extraneous alcohol. Turning to the tables we find of 54 samples only 11 that are under 10 per cent., and 43 samples over 10 per cent.; showing that all of the 43 samples had been fortified more or less. Some were fortified only 10 per cent. over their original strength, while others varied in this fortification from 20 even to 50 per cent. over their original natural strength; and one sample, the first on the tables, was fortified up to 27¼ per cent., or nearly 170 per cent. over the assumed natural strength.

This wine was an unlawful wine, as the custom-house regulations do not permit of any importations of wine over 22 per cent. of alcohol, and it should have been seized by the United States authorities. How much of this kind of business has been carried on by the importers cannot now be told, but the government must have been defrauded of very great amounts by such means, for it does not levy duty, as it ought to, according to the alcoholic strength over and above the original natural strength.

Port wines.—From Mr. J. B. Keene's reports to the British Government it seems that the natural average strength of unfortified port wines is 13¼ per cent. absolute alcohol. Yet, of all the forty samples analyzed by Dr. Bleasdale, the lowest sample showed 17.115 per cent. of alcohol, and the average of all the samples showed 19.324, which plainly indicates an addition of quite 6 per cent. of distilled spirits, from which the United States Government has derived no revenue. And three of the samples contained an illegal strength, being over 22 per cent. in alcoholic strength. These three samples should have been confiscated to the government.

Sherry wines.—Mr. J. B. Keene has placed the natural alcoholic strength of sherry wines at 17.412 per cent. absolute, but I am much inclined to believe that Mr. Keene has been imposed upon in the samples sent him, and that no wines of the Xeres district ever go over 16 per cent. absolute alcohol by their own fermentation, nor do I believe they ever reach 16 per cent. Still, even if we adopt Mr. Keene's figure of 17.412, there is yet an average addition of 3 per cent. of distilled alcohol of the 48 samples reported upon by Dr. Bleasdale, who has found an average strength of 20.406 for the 48 samples analyzed by him. Of these samples 9 should have been seized by the government, being over 22 per cent. in alcoholic strength. And thus has the United States Government been quietly defrauded of its revenues for years in every port of entry in the Union. The simple fact of the case is that the United States citizen is called upon to pay a tax upon the spirits required by him for the manufacture of angelica, muscat, port, and sherry wines, while the importer has no such tax to pay, and therefore has the advantage over our native producers of that class of wines. The only remedy is to place a specific duty on all natural wines that do not contain over 11 per cent. of alcohol (say 40 cents per gallon, the present duty), and on all wines over 11 per cent. so much for each per cent. over that amount of alcoholic strength. I would suggest 2½ cents for every degree of absolute alcohol over and above 11 per cent., in addition to the 40 cents already levied. I would suggest that every invoice be tested for its strength (it would require but ten minutes to do it accurately), and that if any wines be found to contain more than 22 per cent. of absolute alcohol that they be immediately seized by the United States collector of customs and forfeited to the government.

Not wishing to trespass more upon your very valuable time, I will close with the hope that you will be able to use the inclosed documents in full, as they will be very valuable for future reference and future legislation.

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With very respectful regards, believe me truly yours,

ARPAD HARASZTHY,
President State Board of Viticulture.

REPORT ON ANALYSIS OF FOREIGN WINES IN UNITED STATES BONDED WAREHOUSES AT SAN FRANCISCO.

[Made for the California State Vinicultural Society by John I. Bleasdale, D. D]

A report upon and statements of analysis of foreign port, sherry, and claret wines lying in bulk in the bonded warehouses of San Francisco, Cal., between December 10, 1879, and April 15, 1880, collected under authority from the Secretary of the Treasury, Washington, for the purpose of being analyzed by Rev. John I. Bleasdale, D. D., F. G. S., &c.

I have the honor to submit the following report upon 40 samples of port wines, 48 of sherry, and 54 of clarets, collected by myself in the bonded warehouses of this city, in accordance with instructions conveyed in the following communication from Arpad Harasztby, esq., president of the State Vinicultural Society:

"JOHN I. BLEASDALE, D. D., *&c.*:

"I inclose authority from the Secretary of the Treasury, to collect foreign wines now in bond. Get a number of the average samples of the larger and usual importations of ordinary and low-grade prices of port, sherry, and claret; port from Portugal, or England, or France; sherry from France, Spain, or England; claret or red wines from wherever shipped. Get enough samples for a complete test. Find amount of absolute alcohol of each sample, approximate amount probably added, making deductions from the *normal* amount usually produced naturally in each section. Find amount of tannin, free acid, and combined acid. Make the report as concise as the subject will permit.

"ARPAD HARASZTHY."

Accompanying the letter were permits to deliver samples addressed to the several keepers of bonded stores, as under—

"Storekeeper at ——— will deliver to bearer the following samples of wine, viz: One pint of any he may select for analysis.

"E. G. WAITE, *Naval Officer.*

"By order of the Secretary of the Treasury.

"J. McNULTY, *Collector.*"

All of the samples were drawn out of casks, and each one represents a parcel consisting of a number of casks of the same brand and shipment. It is rather to be regretted that no bottled samples were directed to be analyzed, as it would have been instructive to have compared them, and so shown fully the characters of all, especially that of the French clarets; because the aim of the makers of red wines in this State is directed, for the most part, to the production of wines of the claret character.

With regard to the processes of analysis, I would remark that, as two or more days are required to complete some of them, and as the government did not allow sufficient samples; there appeared to be no other course open, after a preliminary examination, than to separate the best and worst, in respect of free and combined acids and tannin, from the middling, in which little or nothing characteristic was discovered. Light wines of low alcoholic strength, such as the clarets, are very liable to undergo change after a bottle, especially a small one, has been opened two or three times, and to form acetic acid, or become moldy, which would vitiate the results afterward obtained.

There was found a very considerable quantity of sulphuric acid in both the ports and sherries, which was determined in each separate sample as sulphuric anhydrite. The tannin (tannin acid) was determined as tannate of lead, according to Wittstein's formula; and lastly the total organic acids, free and combined, as tartaric, on Delapiè's formula, by multiplying the number of cubic centimeters of decinormal soda used to neutralize the acids in 20 cubic centimeters of the wine by 0.0375.

The greater part of the samples were distilled oftener than once, in which case, the decimals represent the means.

The *decimals* showing the weight by *balance* of the alcohol in the wine are given for the use of any one who may wish to check the calculations deduced from them, which, though near enough, may possibly have in an instance or two fallen short of absolute accuracy.

From the decimals the spirit strength is recorded, 1st, according to tables of British standard proof (Sykes' hydrometer), as recently revised by Mr. J. B. Keene, of the distillation department of customs, London, considered to be the most reliable, as well as the most simple and easy, from which to calculate the amount of absolute alcohol. The alcoholic strength of the wines is given in volume per cent. of proof spirit.

By measure in mixtures of alcohol and water, the alcohol forms the larger portion in the inverse ratio of its specific gravity; and if equal quantities by measure of alcohol and distilled water be taken and mixed, the united bulk will prove less than when separate by 3°.74 per cent. So the calulations are based upon the value of alcohol in proof degrees.

My attention had been specially directed to the the French clarets. The general average strength found from the samples was, as British-proof, 20.0105—as alcohol, 11.4345.

As already mentioned, the tannic acid was determined as tannate of lead, giving as the average of 10 samples of the best, 0.448 per cent; while 10 of the most inferior 0.325 per cent.

	Per cent.
The ten best averaged volatile free acid	0.128 as acetic.
The ten best averaged fixed and combined	0.4513 as tartaric.
Total	0.5793

	Per cent.
The ten worst gave free acid	0.2021
The ten worst gave fixed and combined	0.4820
Total	0.6841

Artificial coloring matters were sought for, especially such as the juice of huckleberry, but not found; neither was logwood, Brazil-wood, nor beet-root coloring, nor fuchsine, nor acetate of lead. The color was all of vegetable origin. When fresh from the cask it was very deep purple, no sample showing the characteristic Burgundy red, and excepting a few of the best, notably those branded AV., were a general average of so-called ordinary Bordeaux wines. Besides the 54 separate samples, a few others were partially analyzed in search for artificial coloring; but they are not reported upon, as they had evidently been fortified, and belonged to what are sometimes called "doctors"—meant to raise the strength and body of poorer kinds.

The average spirit strength of those not perceptibly fortified was British standard proof, 19.4077 alcohol=11.409

The highest strength was 27.20=15.520.

The lowest strength was 15.40=8.787.

Number of samples above the average, 27; number samples below the average, 26; total, 53.

One sample was fortified as highly as 48.2 British-proof, or alcohol, 27.540. It appears in the first line of the analysis, but was rejected when computing the general average strength of the samples.

The Port wines.—Of the port wines collected, 40 samples were selected for analysis, as fairly representing the characters of the rest, 49 in number. With four exceptions all had the appearance of being ripe old wines, having either deposited naturally much of their original coloring matter, or been deprived of it by the nature of the finings put into them. They were smooth on the palate, moderately free from sugar, and holding much less tannin than is usually found in good samples of London Dock port. Taken one with another, they were fair samples of what at present is known as Oporto wines. They had been heavily sulphured, some of them excessively. The method necessitated by the smallness of the quantity allowed by the government was, after a preliminary examination, to take equal measures of ten samples and mix them together in a bottle, and analyze. Ten samples yielded an average of 0.7939 per 1.000 sulphuric anhydride.

	Per cent.
Average of tannin in ten of the best	0.0243
Free volatile acids computed as acetic	0.1680
Fixed and combined computed as tartaric	0.4370
Sulphuric anhydride	0.00793
	0.63723

Regarding the important point of added alcohol, I found much difficulty in obtaining a fair average of the natural strength of real port—the pure wine of the Alto Douro. For this purpose I examined carefully the official reports of the royal commissioners for the wines and vineyards of Portugal, 1867 and 1868, and found that the highest strength attained in natural port of the Alto Douro was made in the hottest locality and most highly cultivated vineyard of Traz-os-montes. I translate the following parapraph:

"There are localities on the Douro, as are nearly all those where the vineyards are situated on the right bank of the river, between the Pinhao and the Tua, in which the greater part of the good kinds of vines produce musts which will mark on the glucometer 20° of sugar, in ordinary years; that is to say, 30 kilograms of sugar to the hectoliter. In other localities the mean degree of sugar does not exceed 15°, and there are situations where the musts do not reach 15°."

The Portuguese commissioners evidently use Beaume's hydrometer, and, as hardly two of them made by different makers agree, there may be considerable errors in the strengths stated, though not sufficient to vitiate the figures for practical purposes. And, again, if there be errors in the indication of sugar in the musts, the errors are constant for the same instrument.

After calculating a great number of spirit-strengths recorded in these reports, either as alcohol, weight of sugar, or in degrees of the glucometer, I arrived at the average which I have adopted in this report, viz., 15.5 alcohol = 27.163 British proof. The approximate quantities of added alcohol was originally computed at that strength; but shortly before the analyses were completed, I became aware that Mr. J. B. Keene, of Her Majesty's customs, London, had been engaged upon the distillation of the wines of Portugal and Spain, and on application being made he kindly sent me a copy of his reports. The number of samples obtained by Mr. Keene from Traz-os-montes, districts of Villa-Real and Braganza, was 41, and the average strength as British-proof, 23.602 = alcohol 13.467.

There being about 1 per cent. difference between the alcoholic strength obtained by him and that deduced by me from the commissioners' reports, 14.265 = 25, British-proof, I adhered to my own estimate, because some of the foreign ports come from countries where the average amount of alcohol in the natural wine rules higher than that found by Mr. Keene in samples from Traz-os-montes. His determinations of strengths of European wines, especially those of Spain and Portugal, of which these are, Spanish, 554, and Portuguese, 457 samples, are very interesting to Californian viniculturists, as they supply standards of strength when not fortified. As an appendix to this report I have made an abstract of his tables for that purpose.

Considering the large quantities of port and sherry already manufactured from our native wines, and the ready and increasing demand for them, the calculations I have made place in clear light the disadvantage at which the California wine maker is placed who has to pay to the United States revenue-tax on the alcohol he must needs use for fortifying, while the foreigner can use alcohol at discretion without tax. Now, the 40 from the bonded warehouses yielded an average of 33.817 British-proof = alcohol 19.324—the amount of proof spirit added being 10.215 per cent., if we take Mr. Keene's results.

Port wine is manufactured in the California wine districts where malvasie and zinfandel, taken together, average less than 13.5 alcohol, and sherry where the strength hardly reach 14. of alcohol. But to compete with the foreign they require necessarily to be highly fortified.

Sherry wines.—Number of samples specially analysed, 48; highest strength British-proof, 40.995 = alcohol, 23.425 per cent.; lowest strength British-proof, 29.400 = alcohol, 16.800 per cent.; number of samples above average, 22; number of samples below average, 26; general average of the 48 samples, 35.710 = alcohol, 20.406 per cent.; tannic acid, 0.210 per cent.; sulphuric acid, free and combined, ten worst samples, 1.600 per 1,000; sulphuric acid free and combined, ten of the best samples, 0.891 per 1,000.

An average of 25 samples gave for other acids, computed as tartaric, 0.376 per cent

N. B.—In 1874-'75, Mr. J. B. Keene determined 30 samples of sherry wine as follows Number of samples, 30; highest strength British-proof, 40.30; lowest strength British-proof, 27.50; above average, 14; below average, 16.

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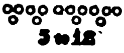
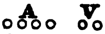
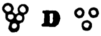
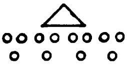
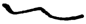
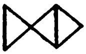
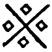
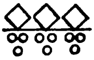
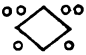
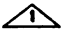
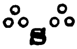
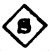
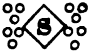
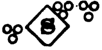
613 Merchant street, San Francisco, Cal.

Analysis of claret wines obtained from bonded warehouses at San Francisco, Cal.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance, specific gravity at 60 F.	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	Remarks.
				Per cent.	*Per cent.*	
Battery	Alpo Zeli	S & C	.97580	48.200	27.542	
	Bengale	D B	.98036	27.200	15.520	This sample was evidently sent in order to fortify poorer wine, and is not computed in estimating the general average strength. It serves to show how highly wines are fortified sometimes.
Gibbs	do	T R	.98066	26.600	15.049	
	Do	T R	.98246	24.250	13.837	
	Do	P & F	.98272	23.300	13.295	
Pacific	do	A V	.98492	20.200	11.526	
Danforth's	Buenos Ayres	W & B	.983575	22.050	12.582	
Battery	Callotta	A D S	.98644	18.500	10.612	
Danforth's	Delphine Melanie	F C R	.98256	22.500	12.838	
Battery	do	S	.98550	19.250	10.984	
	Do	J L	.98620	18.000	10.285	
	Do	A S & C H S & C	.98559	19.249	10.984	Tannic acid average of 20 samples gave 0.44865 per cent. and 21 others, 0 3440 per cent. Acid free and combined computed as tartaric. 20 samples average 0.5691. 18 others average 0.6302.
	Do	P D & C	.98716	16.490	9.409	
	Do	P M	.98736	16.300	9.390	
	Do	H S & C	.98312	22.950	13.095	
	Do	E S F	.98480	19.900	11.355	
Gibbs	do	M	.98800	15.400	8.787	
Battery	Equator	H S & C	.98118	25.550	14.579	
	Do	F C K	.98112	25.800	14.721	
	Do	P D A	.98516	19.570	11.166	
	Do	P D C F	.98428	20.800	11.868	
	Do	S	.98516	19.600	11.148	
	Do	B & C	.98509	19.900	11.212	
	Do	A S & C H S & C	.98524	19.250	10.984	
	Do	H S & C	.98520	19.250	10.984	
	Do	P D & C	.98440	22.100	12.510	
	Do	J L	.98567	18.600	10.613	
	Do	P D	.98550	19.250	10.984	
	Do	J L	.98636	17.740	10.010	
Gibbs	do	F P	.98373	21.700	12.382	
	Do	J S M	.98793	16.080	9.175	
	Do	Q	.98772	15.740	8.981	
	Do	J D F P	.98392	21.520	12.266	
	Do	F P	.98477	20.600	11.754	
	Do	J S B	.98480	16.800	9.586	
Pacific	do	J L	.98520	19.250	10.987	
	Guayaquil	P F E	.98716	16.800	9.586	
	Do	A V	.98600	17.000	9.700	
Danforth's	Maipu	$^{147}/_{182}$	.98477	20.200	11.540	
Pacific	do	A V	.98486	20.150	11.497	
	Do	A V	.98304	22.950	13.095	
	Do	J C	.98512	18.300	10.442	
	Do	A V	.98512	18.300	10.442	
	Do	P G S	.98604	18.000	10.271	
Battery	do	P D & C N B	.98568	19.000	10.841	
Danforth's	Quillotta	J P	.98658	17.400	9.928	
	Do	R T	.98337	22.350	12.753	
	Do	A V	.98658	17.400	9.928	
Pacific	do	Hand	.98491	20.100	11.469	
	Do	A V H	.98566	18.900	10.784	
	Do	A V	.98284	23.300	13.295	
	Do	W R	.98312	22.500	12.830	
	Do	A V	.98512	19.900	11.355	
Danforth's	Guayaquil	A V	.98683	16.800	9.558	

JOHN J. BLEASDALE, D. D.,
Organic Chemist.

Analyses of port wines obtained from bonded warehouses at San Francisco, Cal.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance. (Specific gravity at 60° F.)	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	By taking the original wine at 25 degrees, British proof, the proof spirit added has been—
				Per cent.	*Per cent.*	*Per cent.*
Gibbs's	A. C. Defredus........	BFR	.97616	34.000	19.400	9.000
	Beecroft................		.97725	31.900	18.700	6.900
Pacific................	....do	F&C	.97376	37.950	21.654	12.950
	Do....................	F&C	.97534	35.200	20.085	10.200
	Bengale		.97704	31.150	17.774	6.150
Gibbs's	British Nation..........		.97573	34.550	19.714	9.550
	British Army...........	◇	.97544	34.200	19.515	9.200
Pacific..............	British Consul.........	◇	.975440'	35.200	21.369	10.200
Danforth's	Bruce....................	◇	.97646	33.498	19.114	8.498
Gibbs's	Cape Clear		.97496	35.850	20.456	10.850
	Charles Coteworth....	L & C	.97728	31.802	18.147	6.802
	Do....................		.97805	30.880	17.690	2.145
	Do....................	L & C	.97712	32.100	18.701	7.000
Danforth's	....do	◇	.97726	31.998	18.258	6.998
	Do....................	4/8	.97727	32.098	18.215	7.098
	Do....................	B	.97701	32.798	18.714	7.798
	Do....................		.975658	34.898	19.910	9.898
	Do....................		.97586	34.550	19.714	9.550
Gibbs's	City of Amoy..........		.97488	36.280	20.701	11.280
	Do....................		.97686	32.800	18.716	7.800
	Do....................		.97821	30.450	17.374	5.450
Pacific	City of Bernares		.97592	34.520	19.697	9.520
Gibbs's	City of Vienna	◇◇◇◇	.97684	33.150	18.915	8.150
	Do....................		.97542	34.200	19.515	9.200
Pacific..............	Corolla		.97433	37.250	21.255	12.250
Gibbs's	Dunnerdale		.97133	42.600	24.308	17.600
	Do....................		.97396	37.950	21.654	12.950

Analyses of port wines, &c.—Continued.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance. (Specific gravity at 60° F.)	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	By taking the original wine at 25 degrees, British proof, the proof spirit added has been—
				Per cent.	*Per cent.*	*Per cent.*
Pacific	Eskdale	◇◇	.97408	37.500	21.398	12.050
Danforth's	Galatea	△	.97344	38.640	22.048	13.640
	George Bewley	◇	.97394	39.023	22.694	14.023
Gibbs's	Jena	✷ CM	.97740	31.150	17.774	6.150
Battery	Marie	P D & C	.97651	33.891	19.338	3.868
	Do	P D & C F D	.97426	37.302	21.284	5.813
	Do	P D & C	.97580	34.611	19.748	4.277
Gibbs's	Oakworth	○○ ○○ ○○ ○ ○ ○ C M	.97636	33.150	18.912	8.150
	Pizarro	○ ○ ○ ○ ○ ○	.97484	36.550	20.870	11.550
	Strathspey	N M	.97868= mean & .97849	34.599	19.741	9.399
	Tyaca	✷ C M	.97840	30.450	17.374	5.450
	Victoria Nyanza	○○ ○○ ○ ◇S ○ ○	.97579	34.894	19.859	9.894
Battery	Valentine	P D & C dragon	.97813	30.000	17.115	1.642

Analyses of sherry wines obtained from bonded warehouses at San Francisco, Cal.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance, specific gravity at 60 F.	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	Estimated alcohol added.	Supposing the original wine to have had 23 per cent. of proof spirit, then the quantity of proof spirit required would be—	Remarks.
				P'r ct.	*P'r ct*	*P'r ct.*	*P'r ct.*	
Danforth's.	Abernyte	P	.973650	38.298	21.853	8.729	20.376	Acids free: Tartaric and others computed as tartaric, 0.376 per cent. of 25 samples; anhydrous sulphuric, 25 samples, gave per 1,000, 1.601; 10 others, 0.891 per 1,000 The amount of tannic acid was very little indeed.
	Do	⊗	.943685	31.300	17.802	4.740	8.300	
	Do	◇JHC◇	.973449	38.599	22.025	8.901	13.599	
	Do	◇H◇	.977500	31.150	17.774	4.650	8.150	
	Do	◇JHC◇ B	.976270	33.850	19.315	6.191	10.850	
	Do	◇H◇	.977500	31.800	18.145	5.070	8.800	
Gibbe's	do	E DGC S	.974560	36.550	20.857	7.730	13.550	
Danforth's.	B. Reiz	BL	.978060	30.800	17.574	4.450	7.800	
Pacific	Beecroft	◇W◇ F	.973630	38.200	21.797	8.673	15.200	
Gibbe's	Blinfell	H&D	.978300	31.150	17.774	4.650	8.150	
	British Nation	A DGC S	.974440	36.850	21.027	7.888	18.850	
Danforth's.	Campadre	Amontillado.	.975653	35.300	20.142	7.010	12.300	
	Centaur	△	.973049	39.299	22.417	9.300	16.299	
Gibbe's	do	UDGC S	.973560	38.650	22.025	8.970	15.650	
	Do	I DGC S	.973960	37.950	21.654	8.530	14.950	
Danforth's.	Charles Coteswroth.	CD Nº4	.975000	35.850	20.456	7.475	12.850	
	do	Ex super.	.975720	34.800	19.857	6.740	11.800	
	Do	do.	.975670	34.550	19.714	6.590	11.550	
	Cormorant	◇H◇ Ⓗ	.973650	38.279	21.832	8.718	15.279	
	Craigmiller	◇H◇	.972839	88.998	22.252	9.128	15.998	
	Do	⊗	.975990	35.200	20.087	6.968	12.200	
	Do	◇H◇	.975070	35.750	20.395	7.275	12.750	
	Do	⊗	.976560	33.400	19.058	5.934	10.400	
	Dunderdale	SE C	.974540	36.800	20.998	7.873	13.800	
	George Bewley	╳◇◇◇╳	.975156	39.005	22.270	9.114	16.005	
	Do	SS&G	.975256	35.443	20.238	7.100	12.443	

Analyses of sherry wines, &c.—Continued.

Name of bonded warehouse.	Name of the ship.	Brands and marks.	Strength indicated by balance, specific gravity at 60° F.	Strength as British proof by Sykes's hydrometer.	Absolute alcohol in same.	Estimated alcohol added.	Supposing the original wine to have had 23 per cent. of proof spirit, then the quantity of proof spirit required would be—	Remarks.
				P'r ct.	*P'r ct.*	*P'r ct.*	*P'r ct.*	
	Do	◇◇◇◇◇◇◇	.974050	37.500	21.398	8.273	14.500	
	Do	80/400	.975900	34.100	19.456	6.340	11.100	
	Do	VHC	.975864	31.510	19.691	6.567	11.510	
Gibbs's	do	⊿⊿⊿ VP	.975360	35.200	20.085	6.961	12.200	
	Do	DG&C S	.974240	37.250	21.226	8.131	14.250	
	Do	SE C	.974690	36.550	20.855	7.731	13.550	
	Do	◁ ◁ ◁ P	.975560	35.200	20.008	6.961	12.200	
	Do	AHWA	.977600	31.600	18.031	5.455	9.600	
Danforth's	Golden Gate	◇B P	.973049	39.299	22.417	9.300	16.299	
	Margaret Trimble	P	.875435	35.400	20.199	7.007	12.400	
Gibbs's	do	B Seco	.978910	20.400	16.774	3.561	6.400	
forth's.	Nelson	◇◇◇	.972849	39.744	22.678	9.554	16.774	
	Do	◇B	.976700	33.000	18.831	5.706	10.00	
Gibbs's	Oriflamme	....	.976140	34.100	19.457	6.333	11.100	
	Patterdale		.973160	39.350	22.453	9.329	16.350	
Danforth's.	Staffordshire	Super.	.972849	39.800	22.710	9.586	16.800	
	Vancouver	SS	.972040	40.995	23.339	10.271	17.995	
Gibbs's	do	DP PEE G	.975500	35.200	20.085	6.961	12.200	
	Vale of Nith		.973690	38.000	21.683	8.559	15.000	
Danforth's.	Vernon	Fine	.975477	35.200	20.008	6.975	12.200	
	Do		.975880	34.550	19.714	6.590	11.550	
	Grasmere	◇H	.977200	32.450	18.716	5.392	9.450	

JOHN J. BLESSDALE, D. D.,
Organic Chemist.

APPENDIX 1.—*General abstract of averages of the wines of Portugal.*

[Abstracted from the official report of Mr. J. B. Keene, head of the distillation department of Her Majesty's customs, London, 1875, presented to the commissioners of customs, and checked; and the alcoholic strengths computed by John I. Bleasdale, D. D., Organic Chemist.]

Province.	Red.	White.	Totals.	Highest strength.	Lowest strength.	Above average.	Below average.	Average.	Alcohol.
Algarve	18	......	......	30.500	24.000	8	10	26.66	15.2111
	......	2	20	26.900	26.000	1	1	26.45	15.0927
Alemtejo	32	......	......	30.100	24.200	9	11	26.64	15.2110
	......	20	.....	32.500	21.900	7	13	24.93	14.2250
	......	......	52	32.500	21.900	22	30	25.69	14.6590
Beira	117	......	......	38.800	11.700	66	51	24.91	14.2139
	......	12	......	82.900	22.500	4	8	26.57	15.1610
	......	......	129	38.800	11.700	74	55	25.07	14.3052
Minho	12	......	12	20.000	14.200	6	6	17.38	9.0927
Entre Minho e Douro	7	......	7	18.000	12.300	3	4	15.20	8.6733
Estremadura	119	......	......	40.000	20.000	43	76	25.77	14.7047
	......	44	......	50.000	23.000	18	26	29.10	16.6046
	......	......	163	50.000	20.000	60	103	26.72	15.2467
Tras os Montes	38	......	......	37.500	19.000	18	20	23.46	13.3875
	......	3	......	29.800	23.800	1	2	25.10	14.1797
	......	......	41	37.500	19.000	18	23	23.62	13.4650
Madeira	......	4	4	37.800	31.300	1	3	33.45	19.0870
Sundry	2	......	2	26.200	25.000	1	1	25.60	14.6077

ABSTRACT OF THE ABOVE.

Province.	Red.	White.	Totals.	Highest strength.	Lowest strength.	Above average.	Below average.	Average.	Alcohol.
Natural wines	318	......	......	31.200	11.700	167	151	24.02	....
	......	63	......	31.300	22.500	29	34	25.53	....
Fortified wines	25	......	......	40.000	28.400	11	14	34.600	....
	......	24	.....	50.000	27.000	8	16	33.990	....
	......	......	49	50.000	27.000	22	27	34.300	....

REMARKS.—These investigations prove the spirit strength at British proof of 318 samples of natural red wines of Portugal supplied by the Portuguese Government to the Government of Great Britain, to be, as British proof, 24 02 per cent., or the same computed as alcohol, 13.7061, and 63 samples of natural white wine, to be British proof, 25.53, as alcohol, 14.5677 per cent.

Fortified red wines, 25 samples: Average at British proof, 34.60; average as alcohol, 19.4372 per cent.

Fortified white, 24 samples: British proof, 33.9900; as alcohol, 19.3951 per cent.

APPENDIX 2.—*Average strength of French red wines procured from thirty departments and determined by J. B. Keene, esq., of Her Majesty's customs, London.*

Department—	
De l'Aude	25.900
Var	22.100
Gard	26.800
Allier	19.200
Tarn and Garonne	20.800
Loiret	17.700
Vienne	20.200
Indre and Loire	19.700
Dordogne	20.300
Indre	18.000
Tarn	23.700
Moselle	18.900
Haut Garonne	22.000
Lot	20.800
Isère	17.100
Maine and Loire	18.900
Corse	24.900
Puy de Dôme	22.700
Charente Inférieure	19.600
Vaucluse	26.400
Ardèche	18.900
Drôme	21.600
Herault	23.600
Beaujolais	21.000

Cher	19.300
Loire and Cher	17.600
Corrèze	17.700
Gironde	19.500
Saône and Loire	20.700
Yonne	18.700
	624.300

At British proof, general average of French red wines	20.810
Absolute alcohol	11.874

Wines of the sherry districts of Spain.

Samples.	Highest strength.	Lowest strength.	Above average.	Below average.	General average over all.
Cadiz, thirty samples (white)	44.200	13.100	13	17	27.060
Seville, thirty samples	40.300	27.500	14	16	33.970

General average of the strength of natural red wines of various countries.

Countries.	Strength.	Averages.	Absolute alcohol.
Italy:			
Piedmont	20.900	General average for Italy, computed at British proof, by J. B. Keene: 6+130.200=21.700.	12.382
Lombardy	19.900		
Naples	23.700		
Roman States	16.800		
Tuscany	20.400		
Sicily	28.500		
Zollverein:			
Baden	19.900	The Zollverein: 3+58.300=19.433	11.088
Würtemberg	17.600		
Rhenish Prussia	20.800		
Austrian Empire:			
Austria (proper)	21.800	Austrian Empire: 2+42.300=21.150.	14.037
Hungary	20.500		
Australia:			
New South Wales	25.900	Australia: 2+49.200=24.600	14.037
Victoria	33.300		
All France, thirty departments	624.300	30+624.300=20.810	11.874

Five samples of the red wines of Spain, from Tarragona.

Highest strength	34.100
Lowest strength	20.400
Above average	5
Below average	1
General average over all	30.25

JOHN I. BLEASDALE, D. D.,
Analyst.

California wines.—During the last three years I have availed myself of many opportunities to study and analyze California wines; and considering that a statement of the more interesting of the results arrived at would have value as serving for comparison with the French clarets, I have submitted 48 samples from the principal vineyard districts of the State. The greater part, however, were produced in the cooler and medium climates, where the conditions are not very dissimilar to those of the most fruitful and extensive wine-yielding departments of France. The tables of French strengths, as found by Mr. J. B. Keene, forming Appendix 2, it will be seen, extend over 30 different departments of France; the wines produced in each of which are shown in their general averages.

The following list shows the average strengths of the natural wines distilled by Mr. Keene in 1874–'75 (1,265 samples in all), and may be of some value:

	Average percentage proof spirit.
Australia	26.39
California	24.83
Servia	24.27
Spain	24.18
Portugal	24.07
Russia	23.43
Greece	22.31
France	20.47
Italy	19.69
Germany	19.41

APPENDIX 3.—*California wines.*

District.	Growers.	Names of wines or of grapes.	Age.	Specific gravity by balance.	British proof.	Alcohol.	Remarks.
			Years				
Sonoma Valley	George Hooper	Miss. White	4	.98246	23.600	13.466	The first thirty samples are natural, and the following nine are fortified more or less: Sonoma County, thirty samples: General average, 22.534; above average, 11; below average, 19; highest strength, 28.610; lowest strength, 14.600; alcohol, per cent., 13.8586.
	Do	Tokay	4	.98102	25.800	14.726	
	Do	Table claret	5	.98421	20.000	11.412	
	Do	do	4	.98842	14.600	7.318	
	Do	do	4	.98810	15.300	8.730	
	Do	Miss. White	5	.98143	25.100	14.328	
	Do	Tokay	5	.98189	24.500	13.980	
	Do	Chablis	5	.98429	20.800	11.868	
Sonoma	J. Gundlach	Gutedel	6	.98169	25.200	14.400	
	Do	do	7	.98242	23.500	13.428	
	Do	Zinfandel	4	.98384	21.800	12.459	
	Do	do	4	.98391	21.400	12.228	
	Do	Riesling	6	.98082	26.100	14.875	
	Do	Cabinet Gutidel	6	.97937	28.610	16.316	
	Do	Zinfandel	2	.98483	19.900	11.355	
	Do	do	5	.98319	22.350	12.758	
Sonoma County	Kohler & Frohling	White wine	3	.98530	19.200	10.971	
	Do	Tokay	3	.98257	23.600	13.425	
	Do	Zinfandel	3	.98478	20.100	11.485	
	Unknown	Riesling	5	.98221	24.220	13.820	
Santa Rosa, Sonoma County.	J. De Turk	Miss. White	2	.98560	18.600	10.613	
	Do	Zinfandel	2	.98520	19.250	10.985	
	Do	do. & black grape	3	.98576	18.600	10.613	
	A. Haranzthy	White Zinfandel	3	.98552	18.920	10.796	
	Do	Miss. White	3	.98593	18.350	10.470	
	Do	do	2	.98452	20.500	11.697	
	Do	Dry Muscat of Alexandria.	3	.98276	23.200	13.238	
	Do	Zinfandel	4	.98386	21.700	12.382	
	Do	Riesling	3 & 4	.98376	21.800	12.439	
	Do	Riesling	3	.98388	21.650	12.353	
Napa County	Unknown	Gutedel	3	.98440	20.500	11.697	Napa County, eight samples: General average, 21.803; above average, 4; below average, 4; highest strength, 25.000; lowest strength, 18.000; alcohol, per cent., 12.4281.
	Landsberger	Berger	2	.98600	18.000	10.271	
Saint Helena	Do	Miss. White	3	.98376	21.700	12.382	
	Do	Zinfandel	2	.98576	18.600	10.613	
	Do	Riesling	3	.98247	23.300	13.314	
Calistoga	Schramm	Zinfandel	3	.98160	25.000	14.285	
	Do	do	3	.98204	24.250	13.857	
	Do	Riesling	2	.98280	22.950	13.114	
Yolo County	Unknown	Miss. White	3	.98396	21.400	12.211	One sample.
Alameda	Keene	Malvasia	3	.98120	30.450	17.395	Two samples fortified wines, viz: Alcohol, 17.2160.
	Do	do	3	.98200	30.910	17.637	
Santa Clara County.	General Naglee	Catawba	3	.98080	26.200	14.950	One sample.
Los Angeles County.	Lachman	Tokay	5	.98576	30.250	17.261	Los Angeles County, six samples: General average, 30.896; above average, 4; below average, 2; highest strength, 31.400; lowest strength, 28.100; alcohol, per cent., 14.0233.
	Kohler & Frohling	Angelica	5	.97918	28.900	16.514	
	Do	do	5	.97798	31.400	17.917	
	Do	Port	5	.97977	28.100	17.460	
	Do	Sherry	5	.97856	30.300	17.289	
	Do	do	5	.97918	29.100	16.604	

NATURAL WINES.—Average of fifteen samples red: British proof, 20.0098 per cent.; alcohol, 11.4209 per cent. Average of fifteen samples white: British proof, 23.4853; alcohol, 13.4012.

General average of the fortified wines: Alcohol, 15.6196; general average of the natural wines: Alcohol, 12.4110.

JOHN I. BLEASDALE, D. D.,
Organic Chemist.

The chairman announced the paper open for discussion.

Professor RILEY wished to make a statement in connection with the facts given which he thought was rather significant. About one-third of the superficial area of land devoted to grape culture has been ruined and abandoned during the last ten years because of the ravages of the phylloxera, and the wine product of that country has been correspondingly diminished, though you study the statistics of the country you find that the sale and export of wines have not diminished in anything like the same ratio. It is a fact that large quantities of California wine have during the past two years been shipped directly from California to France and returned to this country after having been "fixed up" and relabeled with the brand of French wine.

A DELEGATE. I wish to inquire what varieties of grapes are mostly raised in California.

Mr. SARGENT. I understand that there are three hundred varieties cultivated in California, many of them of course being "fancy." A Black Hamburg, our old Mission grape, and the standard varieties of France and Italy are those used for wine-making there. I would like to remark that my knowledge of this subject comes simply from a general study of the State, and I am sorry that some of our viticulturists are not here to give the facts more in detail.

The DELEGATE. I am informed that foreign grapes are mostly raised there. Our heavy wines, such as the catawba, are much superior to those made from any foreign grapes. I would like to know why these grapes are not planted there.

Mr. SARGENT. California varieties of grapes, which would die in a French vineyard, take on a vigorous growth with us. The flow of sap is so great that it drowns out insect life. My impression is that the Catawba is not used while the Mission grape, luscious to the taste and of tender skin, is largely used.

The DELEGATE. I have seen some statement that the phylloxera is troublesome in California.

Mr. SARGENT. Very slightly, and in the instances when it has occurred it is thought to come from imported vines. All these diseases of the vine make very little progress there, and soon die out.

Dr. McMURTRIE thought that most of the vines grown in California were Hungarian. He thought that a little more than 5,000,000 gallons, as stated by Mr. Sargent, were imported from all sources. In regard to the character of wine brought from France, Mr. Sargent had called attention to the laws of that country. The statistics show that in 1878 France produced about 25,000,000 hectoliters.

The annual consumption amounts to about 40,000,000. The production of France in 1880 was about 33,000,000 and the importations from all sources about 7,000,000, so that even for that year the stocks available were barely sufficient for home consumption, and it has always been a question with me where they get pure wines to export to the United States.

Professor TAYLOR thought the question raised with regard to the character of the vines of California very important, and after referring to the eleven distinct species in this country and their adaptability to different sections, called upon Mr. Saunders for further information.

Mr. SAUNDERS said it was well known that the wines of California are produced from the same class of grapes as the wines of Europe. He could not say why they grew those grapes instead of our own native grapes. Mr. Longworth had spent $30,000 in importing foreign grapes, and at last had to resort to Catawba, which shows that an early idea prevailed that good wines could not be produced from our American species, and foreign grapes were introduced. When California first entered into the cultivation, they found that the foreign grapes did very well. They had been planted by the early missionaries, who, many years before, introduced the foreign grape. They were known as the Mission grape, and he presumed that better wines are made from them than from the fruit of American vines. He had seen a statement that American grapes would not make raisins. Raisins are not made from American grapes, but from grapes grown in America. We have not yet found any of our American varieties that will make raisins fit to compete with the raisins made from the foreign grape.

Mr. Saunders was of the opinion that wines from American grapes would increase in value as we go on improving our American varieties. We should bear in mind when we talk about California wines and raisins that we are then talking about a product produced entirely from foreign grapes.

Mr. Chamberlain, from the committee on resolutions relative to the exclusion of American products from France, submitted the following report:

To the Chairman of the National Agricultural Convention:

Your committee, to whom were referred the resolutions relative to the exclusion of American products from the markets of France, and recommending retaliatory legislation by Congress, beg leave to report:

That, in our opinion, the said resolutions involve grave and delicate questions of international policy, which this convention has not the time fully to discuss, nor the ability to pronounce upon without the most careful deliberation; and further, that these questions do not fall within the proper scope of our deliberations.

We therefore recommend that the entire subject be left to the wisdom of the proper departments of our government, without any special action or recommendation from this body.

Respectfully submitted.

W. I. CHAMBERLAIN,
ALEX. HERON,
G. D. FISHER,
Committee.

Mr. CHAMBERLAIN. I wish to say on behalf of the committee that there is no intention of discourtesy to the gentleman who kindly favored this convention with his views on the subject, but the report of the committee shows why, in our opinion, this convention cannot wisely handle the resolutions.

The report of the committee was adopted.

Professor RILEY wanted to add a word in reply to the question as to why the *Vitus vinefera* is grown in California in preference to our American species. The climate being more favorable, the vine flourishes better than ours. Another reason is that until within a few years our American grapes have not produced wines that would compete or compare with the better class of European wines, principally because nearly all our native varieties have a fiery flavor, which is very distasteful to the wine drinker, especially if he has formed the taste in Europe; this is the reason why those that are native east of the Rocky Mountains have not made their way into California. They are being sent there at the present day in larger and larger quantities, because we have already shown that some of our varieties do make an excellent wine. The professor believed that eventually some of our species would be found growing side by side with the European vines.

Mr. SARGENT believed that one reason why the European grape does so well in California is because the climate is so favorable to its development and there being no danger of mildew. There is no reason why a delicate grape should not grow there in luxuriance. He suggested that while they might be called "foreign" grapes, they were in reality American. The Mission grape had been planted there a hundred and twenty years ago, and are certainly native to the soil.

Mr. SAUNDERS said that the foreign grape was sometimes talked of as being "weak," and our native grape as being "strong." The foreign grape is quite as strong as the latter, and makes as much wood. He had known them to make a growth of 30 feet in length in one season. There is no trouble about the vitality, provided it has the proper climatic conditions. The European grape suffers sooner from dry weather than our American grapes do, although both of them will sometimes show the same appearance of mildew on the upper surface of the leaf; and it is generally supposed to be caused by want of moisture. He had noticed years ago that sometimes one grape was attacked, sometimes another, and sometimes both, under certain conditions. If you can prevent the foreign grape from mildewing, you can grow it here as well as in California. He had grown the Black Hamburg in Baltimore thirty years ago. It is a matter of climate simply, and this is the reason why we cannot grow the best foreign varieties. In growing these finer varieties we must select climates exempt from mildew. What is known as the chicken grape has many of the characteristics of the best wine grapes of Europe—very little pulp and plenty of rich juice.

Mr. Saunders thought the time would come when our best grapes would be produced in the highlands of Virginia. The time will come when the land will be sought to suit the grape, and not until then will Americans be able to produce the best wines from their native grapes.

The PRESIDENT. Inasmuch as this subject comes up under another head, the Chair will call for a paper on the "Horticultural interests of Wisconsin," by Mr. Peffer.

The following paper was then presented and read by Mr. Smith, of he Wisconsin delegation:

HORTICULTURE IN WISCONSIN.

BY MR. PEFFER.

Mr. PRESIDENT AND GENTLEMEN OF THE CONVENTION: Horticulture in our State may properly be divided into three divisions, viz: First, apple and pear growing; second, the smaller fruits and flowers, and third, market gardening. We will consider the subject very briefly under the three heads.

The history of the apple and pear growing interest in the State has not, upon the whole, been as great a source of profit to those engaged in it as either of the others. When the wide-awake eastern men first began to settle in the Territory, they, very naturally, brought many of their eastern tastes with them, and among them was the desire for fruit. It was very natural and reasonable that they should think that the varieties of apples and pears that did well and were almost universal favorites in their native States, in about the same latitude as they were occupying here, should likewise do well here. They planted and grafted and set with their pet varieties, and after years of toil and care they found to their sorrow, as well as their great pecuniary loss, that their trees were nearly all dead or dying. What should be done? The idea of giving up in despair after one disappointment, however severe it might be, is not a common trait of either our eastern men or of their descendants in the West. They had not the experience of others about them for their guide; hence, there seemed to be but one of two courses left—either to abandon apple and pear growing, or else to commence anew with other varieties, and almost blindly guess as to such ones as might prove to be a success. They chose the latter course and commenced a long series of experiments which is yet far from an end. To say that they made no progress would be as unjust as to say that they had been completely successful. As regards the measure of success, perhaps, I can do no better than to give a few statistics from our secretary of state of the crop reported for the year 1880. This volume reports 67,466 acres of land in orchard. The crop given was 3,743,374 bushels of apples. It is said that one-fifth of the crop was neither gathered nor reported. It should be said in this connection that the apple crop of 1880 was undoubtedly the largest one ever grown in the State. In 1881 it is estimated at only 587,649 bushels. This short crop is doubtless the result of overbearing the previous year, followed by a winter of almost unprecedented severity, combined with other causes, which also rendered the fruit itself much more imperfect than usual, but present indications are that we shall have a very large crop next season.

The varieties that are thought the best, all things considered, and are recommended by the Wisconsin State Horticultural Society, are the Duchess of Oldenburg, Wealthy, Pewaukee, Haas, Fameuse, and Plumb's Cider. An additional list, recommended for favorable locations, is as follows: Tetofsky, Red Astrachan, Saint Lawrence, Fall Orange, Price's Sweet, Alexander, Utter, Westfield, Seek-no-farther, Willow Twig, Golden Russet, and Walbridge. The lists have been changed as the fruit growers have perceived that their recommendations might be improved by dropping one or more from the list, and adding some variety that promised better than the one left off. They will doubtless be changed in the future, for our fruit growers are enterprising and energetic men, and will not rest until we have a list of trees that are as reliable and give as good quality as the standard orchards in the fruit growing districts of the East, and this is not claimed for the present one.

Of pear trees it is estimated that there are over five thousand in the State, of bearing age. These are mostly within from two to twenty miles of the lake. The Flemish Beauty is considered the most reliable variety grown. As a whole, pear growing has been much less successful than that of apples.

Of cherries there are 867,000 trees reported, mostly Morello, Kentish, and Early Richmond. The sweet varieties have not thus far been successfully grown. Of plums there is no report. Our soil and climate is not unfavorable to their perfect development; but the curculio is the great destroyer of the crop. Some varieties of the wild plum are at least partially proof against their ravages, and in such cases good crops may be expected. This is true of the Miner, De Soto, Winnebago, and some others, their quality also being good.

Regarding this branch of our subject, it may be said that our fruit trees grow much more rapidly than upon the Atlantic coast. They come into bearing much earlier and are not as long-lived as eastern trees of the same species and varieties.

We will now turn our attention to the smaller fruits for a short time. While not commercially as important as the apple crop of 1880, it is certain that they are our most valuable fruit interest. This may be regarded as an exaggeration, but in proof we suggest the many and varied locations where they are perfectly at home, but where the larger fruits can never be successfully grown; the short time required for their production, thus bringing them to the new home years before the larger fruits are available, and also bringing them to very many who, for business or pecuniary reasons, may not be freeholders or long residents in one place. A plantation of strawberries may be made in September, which will yield paying returns the following June.

In regard to this fruit, Wisconsin seems to be highly favored. With good cultivation, the Wilson is almost a certain crop. One of the growers of the State who has had them under cultivation since 1860, has since that time failed but once to have at least a paying crop; and usually they have been very large, over 200 bushels per acre being a not uncommon yield. One of the largest, if not the largest, crop ever reported upon one-fourth of an acre in the United States was from Wisconsin. It was 3,571 boxes of merchantable berries, or at the rate of 446¼ bushels per acre. Probably the Wilson constitutes more than three-fourths, if not seven-eighths, of the entire amount grown in the State. Many other varieties are being experimented upon, but thus far nothing seems to be able to supersede the Wilson. It is to be hoped that we shall soon have two or more varieties that will at least equal this one in quality, productiveness, &c., and one of them be at least one week earlier, and another from one to two weeks later, and thus lengthen our strawberry season. Our varied soil, altitude, climate, &c., make the culture of all the small fruits suited to our latitude not only possible, but usually very successful.

Not content with smiling on and blessing all the efforts of the cultivator, Dame Nature promptly takes up the work where he lays it down, and goes steadily and bountifully on to produce annually thousands of bushels each of raspberries, blackberries, whortleberries, and cranberries.

Of the first two, from their native wilds, comparatively little use is made, except in a few counties in the northeastern portion of the State, where they are the source of quite a large revenue; but of whottleberries our annual harvest brings into our treasury $50,000 to $80,000; and the value of our cranberry crop, produced by simple and very cheap modes of culture, reaches nearly or quite half a million dollars annually. What this interest may become when carefully developed is a question requiring as much thought and study as do the possible developments of our grain or live-stock interests.

In the improvement of cranberry marshes, thus far little has been done beyond making ditches and throwing up dams of the material from the ditches, so as to control more or less perfectly the water falling upon and flowing over their surface. The marshes are composed of peat from 1 to 4 feet in depth, resting upon white sand, the sand gradually hardening into a soft sandstone at a depth of 10 to 15 feet. The surface is heavily coated with moss 8 to 12 inches deep, and is very fresh and luxuriant where water is plenty. The surrounding lands are all sand, with 1 to 3 inches of poor vegetable mold on the surface, and have an average elevation above the marshes of only 2 to 4 feet.

In improving, the first effort is to kill the moss, then to get a full stock of vines rooted in and through the dead moss, well down into the solid peat, then to get a flow of water to fully cover and protect the vines from about November 15 to May 1. With those points accomplished, the production of a crop each year is comparatively sure, and further danger of failure will arise only from insects and untimely frosts. In many cases moss killing and stocking with vines is slowly and imperfectly done, and in no case, to our knowledge, has the eastern method of coating heavily with sand and planting vines thereon, been thoroughly tried. Experiments in this direction would be full of interest and might lead to better and more successful methods of increasing the area of productive vines. To eastern cultivators, a method of improvement and culture involving an expense of only $5 to $10 per acre, must seem very slipshod and inefficient, and so it doubtless is. Western cultivators are anxious to learn of better methods, and any details of the management of eastern marshes will be interesting to us.

The production and consumption of strawberries and raspberries is rapidly increasing. The markets of all our towns and villages are well supplied and at moderate prices, which, while they afford the producer a living profit, are still within the reach of all the people, and all are fast learning that these delicious fruits are more healthful than pork, and cheaper than medicine. This knowledge and practice reaches far beyond the town and village, so that plantations of strawberries, especially, are becoming an important item in the general farm garden.

Grapes are little grown for wine, but very generally grown for home use and the village or city market. On our southern slopes and table-lands, Concords and other leading sorts are a paying crop at 3 to 5 cents per pound. The Delaware and Rogers numbers 3, 4, 9, 10, 15, 19, and many other varieties are doing well in many places. The Northern Wisconsin Agricultural and Mechanical Association, whose fairs are held at Oshkosh, and which is supported by the northeastern portion of the State, has long been noted for its splendid exhibitions of grapes. In Delawares it may well be doubted whether its exhibitions are surpassed by any in the United States. These are almost exclusively grown in what is called the Lower Fox River valley, viz., the counties about Lake Winnebago, and thence down the Fox River to Green Bay. One grower near the shores of Lake Winnebago has seventy varieties now under cultivation.

Currants are readily grown, and, with reasonable care, are an almost certain crop. One of the growers who has had a small plantation of them in bearing since 1860, has never failed to have a large crop every summer since that time. He manures his ground well every spring, keeps it free from grass and weeds. The varieties mostly grown are the Red and White Dutch. In all the small fruits we are "well up" in the new and choice varieties. Novelties, even at novelty prices, find an early place in many amateur collections, and are very soon supplied from all our leading nurseries. True, we often gather disappointment instead of fruit therefrom, but our courage and faith never flag.

Floriculture in our State, if regarded only in a commercial point of view, would not figure very largely in the account of either farm or garden products. There are but comparatively few persons who make it an exclusive business; still there are many green-houses that are doing reasonably well, and the number is annually increasing. There are some private ones of which Wisconsin may well be proud; that of Mr. Alexander Mitchell, of Milwaukee, being considered one of the finest and best in the western country. The number of amateur flower-growers in the State is large, indicating refined and educated taste among our citizens, and we believe that no State of our age can make a better showing here than ours.

We will now briefly consider market gardening. Except for the home trade, it is confined mostly to the eastern part of the State, and is carried on most largely for outside markets at two points, Milwaukee and Green Bay.

The home markets are and have for years been well supplied with all the fruits and vegetables of our soil and climate by the small growers in and about our towns and cities.

A few words upon gardening are all that need be said at this time. Our system is much like that of and about New York—heavy manuring and thorough cultivation being with us, as with others, the two things absolutely essential to a successful result.

Perhaps I may, in this connection, be allowed a few remarks on the system as conducted about Green Bay, being better acquainted with it there, as being my place of residence, than elsewhere, and also serving to illustrate other portions of the State. There are good water communications both to north and south; and also railroads reaching in all directions. These, in competition with the water routes, usually give us reasonable and sometimes low rates of freight. In the great lumber and mining districts farther north but little attention is paid to agriculture in any of its branches; consequently, there is a large market there for all kinds of farm and garden produce, and ours is the nearest point from which the want can be supplied. The business of furnishing outside markets commenced about fifteen years ago, and has since grown to quite large proportions, as within the past few years shipments have also been made to New York, Philadelphia, Ohio, Indiana, Illinois, Missouri, Minnesota, Colorado, Texas, and possibly to other portions of our country. Perhaps the best evidence that the business is successful is the fact that none of the gardeners are willing to sell out, except at very high prices.

The question is often asked, "Is not Green Bay too far north for such a business to be successful?" Its latitude is 44½°. Here are a few dates giving the time of the first appearance of some of our crops of entirely out-door culture. The earliest date for commencing plowing, land being in good order, was March 12. The latest was last spring, April 17. The earliest cuttings of asparagus were April 13. Pease have twice been ready for picking June 5, and strawberries June 6. Sweet corn has been in the market July 21. These dates extend back for a series of twelve to fifteen years. They are given as the earliest for such crops within that time, and are of course a few days earlier than the average season with us. Twice within twenty years crops have been killed by frosts in September. Last fall frost was not sufficient to kill Lima beans, except the outside leaves, until October 20.

It should be borne in mind that all the remarks of this paper in regard to either fruit, floriculture, or market gardening are applicable more particularly to that portion of the State south of 45 degrees of latitude. One-half of the State, lying north of this range, is comparatively undeveloped as regards its agricultural capacity. It is now being closely intersected with railroads, and in the near future is doubtless to become the home of a large and thriving agricultural population.

Our State Horticultural Society is not a large one in numbers. I think this is at least partially compensated for by the fact that a large proportion of its members are well-educated, energetic, persevering men whom no discouragements thus far have been able to keep from pursuing a course which we all believe must eventually prove a thorough success, although to many it has seemed to be long in its coming.

The society is about twenty years old, and issues a yearly volume of transactions, which is published by the State, and which, we think, will compare favorably with that of any of our sister States in the Northwest. In one respect we believe that we may justly feel proud of our society. We have a corps of lady writers who annually come forward with their well-prepared papers, and read them at our conventions. They are the wives of our lawyers, teachers, editors, and last, but by no means least, the wives of our farmers. In this we feel that our volume cannot be exceeded if, indeed, it is equaled by any one of its kind in the United States.

This, Mr. President and gentlemen of the convention, is a brief synopsis of the condition of horticulture as it at present exists in the State of Wisconsin. It is imperfect, but your time here is valuable, and other States have claims that may not justly be disregarded. As has been stated, those who have been engaged in some branches of fruit-growing have met with many discouragements, but their courage does not fail. They believe they are working for and toward a great and grand result. They believe that they will accomplish it. Those who are engaged in different branches of business hope and trust that they will succeed.

We have a noble State. We feel that we may justly be proud of being one of the galaxy of States of the grand Northwest, as well as one of the sister States of our Union. In the different branches of horticulture we will not claim any leadership; still, my friends, you may rest assured that we shall not consent to lag behind in the race of progress and improvement. And as you of our older and more thoroughly developed States go forward step by step from one high position to others still higher in your career of progress, as you look about to see those who are keeping pace with you, among the numbers, I feel sure, will be found our own beautiful Wisconsin.

Mr. THOMAS TAYLOR, referring to cranberry culture in New Jersey and the New England States, said that several years ago he had visited a great many of the cranberry plantations of these States for the purpose of discovering the cause or causes of cranberry rot, so prevalent at that time. As a result of his investigations he found that as a rule the rot of the cranberry prevailed principally on plantations where the peaty soil was in a state of fermentation. He recommended to the growers, as a remedy for this condition of soil, liming and thorough irrigation. He found, on making inquiries three years afterward, that several of the large plantations which were treated in this way ultimately produced improved berries, free from rot.

In preparing new soil for planting, the methods vary with the conditions presented in each case.

The most successful are those cultivated on old mill-ponds. Many of these ponds have been out of use for a period of from 30 to 60 years. In this case there is a great accumulation of vegetable, muddy *débris*, averaging from four to five feet in depth. In order to utilize this vegetable matter, the water is drawn off slowly, allowing the sediment to be precipitated to the bottom, forming a loose, peaty loam, well decomposed, varying, when consolidated, from 6 to 15 inches in thickness, resting generally on a porous foundation of sand or gravel. It is found as a general rule where water is plentiful that an absorbing foundation has great value, because the soluble matter of fermentation, such as organic-acids, &c., are quickly removed from the cranberry vines which may be growing under such conditions.

When the soil is ready for planting, from four to six cuttings of the vine are planted about 12 inches apart over the entire surface thus prepared. The cuttings take root quickly under favorable conditions. On the second year they bear a small amount of fruit. On the third year the crop may average from one to two hundred bushels of berries per acre.

When cranberries are cultivated on black sand, which is a mixture of peaty matter and sand, the vine roots sometimes suffer severely from lack of water, especially when they depend more on direct rainfalls than on running water. In this case a clay substratum has a great advantage when situated at a depth of about 18 inches from the surface. The clay retains the moisture for a long period, supplying the roots with the needful element until further rains supply the upper stratum of sand in which the plants are growing.

Common bog-land is generally covered with moss and many varieties of weeds.

The surface or sod is sometimes removed and burned and the ashes returned and spread over the surface. It is valuable in imparting a loose mechanical texture to the soil. The vines are planted on bog-land in the manner already described. It is found that vines planted closely cover the entire surface very quickly, and in a great measure prevent the growth of weeds. When lime was first applied to the cranberry vine in the State of New Jersey it was spread over the whole surface of the bog at the rate of 40 bushels to the acre; considering that the lime was freshly slacked and applied in the dust form and quite caustic it was feared that the foliage would be burned up, but not a leaf wilted, although in some instances the foliage was covered as much as an inch in thickness with lime dust.

When cranberry vines are planted on bog-land which is in a compacted fermenting condition and several feet in thickness, the land should be first drained, then plowed as deeply as possible, and heavily limed and exposed during the winter, thus allowing the surface soil to pass through the stages of fermentation. The land should also be well trenched and subjected to thorough irrigation to free it from organic acids, sulphureted hydrogen, and sulphate of iron, products which frequently abound in bog-land, and which may come to the surface in time if not removed by drainage. The sprinkling of sulphate of lime over growing moss destroys it for a time, and the dead moss serves a good purpose in keeping the surface of the soil moist. Cranberry roots readily take root in moss and grow thriftily, provided the roots of the moss are kept moist with running water.

Mr. **Peffer** said: They have used lime in Wisconsin at the rate of about 20 bushels to the acre, and it was a question whether that might not be safely used on the green vine. But he found that after two weeks of the application of the lime, where the new plants were, that when he removed it there was a certain appearance of scorching, and it may be believed that when scorched at all the vines will be destroyed and die right down. One gentleman had limestone formation, and low-lands, sloughs, or marshes, and they were about 4 or 5 feet deep. He removed the surface about 4 or 5 inches, set the plants in the summer, and tore away or burned up the moss, and then planted the cuttings 2 feet apart. For two years no weeds had appeared. This makes our bed, and in two or three years the vines will cover the ground, and commence bearing the second year, and the third year will produce well. Several plantations in his country have been very successful.

One who has never seen our fields can form much of an opinion of their capabilities. From all he had heard and read, and the little he had seen of Western cranberry growing, he thought a hundred acres such as they make would make a Jerseyman very happy, for the reason that they do so little and get so much. Our best fields are of sandstone, where the water is as soft as rain-water from the clouds. The gentleman last speaking with reference to this paper said we tore up our moss and threw it away. The moss is destroyed only by salting the ground thoroughly, and draining the water off entirely on a warm, sunny day when the sunshine strikes it, and then the hot sun destroys it; then it will come down to one-third of it's original size and becomes a nice bed.

Mr. **Taylor**. Then you do not plant any to fill out those that are lost in different places?

Mr. **Peffer**. Oh, yes; about nineteen-twentieths is produced on vines that nature has planted. We have got the water to them where it was lacking. Our planting has been too far apart and took too long a time. The impression was that about two or three years would give a good growth, but it does not. Five years will produce the finest crop. We never have used sand to any extent. He learned, from reading some interesting reports recently, that it is the custom to use sand to raise cranberries for the Eastern market; is that so?

Mr. **Taylor**. Yes, sir.

Mr. **Peffer**. Our vines seem to do very well, as they grow readily into the dead or decaying moss, and that moss becomes less and less, from year to year, and almost disappears. Then the growth of the vine is built up from year to year. The yield is as high as two or three hundred bushels to the acre, where the vines have the proper age.

Mr. **Taylor**. They grow up through the moss?

Mr. **Peffer**. No, sir, after the moss is killed; one year's growth after another, there will be a depth of cranberries from five to seven inches through the whole crop.

The hour for adjournment, having arrived the president declared the convention adjourned until 2 o'clock.

The convention reconvened at 2.50 p. m.:

The **PRESIDENT**. The chair understands that the report of the committee on signal service is ready, and he calls upon the chairman to present it.

Mr. **BUCHANAN**. The chairman of the committee is absent and requests me to act in his place. I offer the following report:

The committee appointed to consider the relations of the United States Signal Service to the agricultural interests of the country, and to present such statements and suggestions, as might, in the judgment of this convention, be deemed proper to be commended to the attention of the Chief Signal Officer, General W. B. Hazen, beg leave to submit the following report:

1. The Chief Signal Officer has already instituted special services for the benefit of agriculture by way of forecasting, and, as far as practicable, giving timely notice of the approach of northers, frosts, rain-storms, &c. The cotton, sugar, and orange producers are understood to be the special beneficiaries of this service. Within the cotton belt there are now one hundred and fifty stations from which daily reports of temperature and rainfall are received. A special service is also under consideration for the benefit of the grain-growing interests. The feasibility of extending similar services to other agricultural interests and notably those of hay and tobacco is suggested.

2. The Chief Signal Officer has already suggested to the governors of the several States the expediency of instituting a system of weather service to be conducted by the State authorities upon a plan furnished by the United States Signal Service. Meteorological data could thus be gathered through the agency of the State central officers from every county in each State, and thus the climatic conditions of every locality be made known. The data thus collected and published by the United States Signal Service would be available for every purpose for which such data are needed, and could be especially utilized by the Department of Agriculture in determining important questions relating to agricultural production. For instance, if studied in connection with the thorough and comprehensive crop reports so earnestly and justly insisted on by this convention, they would furnish means of ascertaining to what belts or sections of country certain crops are, or are not, appropriate. Some of the States have already adopted the suggestion of the Chief Signal Officer respecting the institution of weather services, and in other States the matter is awaiting legislative action.

3. The United States Signal Service is conducting observations with a view to suggest, if possible, some means of preventing the devastations of grasshoppers in the West. It is suggested by the Chief Signal Officer that it may be practicable to search them out in their fastnesses and destroy them before they begin to migrate from their hatching grounds.

4. These measures adopted by the Chief Signal Officer in the interests of agriculture are duly recognized and appreciated by this convention; and they cordially indorse any efforts he may make to secure on the part of Congress such legislative action as may enable him to carry out these and any other measures which tend to advance the manifold agricultural interests of our entire country.

JOS. A. HOLMES,
S. H. PEABODY,
JNO. L. BUCHANAN,
A. E. BLOUNT,
Lieutenant BIRKHEIMER,
Committee.

The report as read was adopted.

The president stated that the first paper in order was that by Dr. McMurtrie on the mineral nutrition of the vine.

Dr. McMurtrie then read the following paper:

ON THE MINERAL NUTRITION OF THE VINE FOR THE PRODUCTION OF WINE.

BY WM. MCMURTRIE, PH. D.

GENTLEMEN: It is not without a feeling of considerable diffidence that I appear before you to present my views on the subject of this paper, both because of the vastness and importance of the subject and the industry it represents, and because I see before me many gentlemen of a wide experience in practical and successful vineyard management, of which it is certainly not my privilege and right to boast. What I have to say is based upon rather careful observation among some of the more celebrated vineyard districts of the old world, and study of the results obtained in Europe in practical and scientific experimental research. And if the standing this great industry has acquired there, and the great wealth it has added to many of the leading nations of Europe may be taken as evidence of the value of these results, then the principles to be deduced from them may undoubtedly be applied with confidence to the treatment of our vineyards, and the improvement of their comparatively undeveloped productions. For I firmly believe that whatever may be done to increase the quantity and improve the quality of our wines will tend to the material and permanent advancement of the industry here, and if anything I may present will to the smallest degree tend to that end and contribute anything to the knowledge and the improvement of grape culture in the United States, the object of this paper will have been fully attained. I firmly believe that whatever may be done to enable the American vintner to produce large crops of healthy wines of medium quality that may be early sent to market and sold at low prices and thus made to yield quick and profitable returns, will do more to make the industry take a prominent rank among our agricultural productions than the production of special wines can possibly do, and will secure to the vintner his permanent prosperity against any peradventure or question.

The importance of the grape and wine industry in the various parts of the world where it has been long established, or even in our own country where it is comparatively new, is so familiar a theme that it would seem almost superfluous to speak of it here, yet it may prove of interest to recall some figures, showing its relative importance to the different nations, from which the requisite statistics have been attainable:

	Gallons.
Austria, 1876	53,835,777
Hungary, 1873	99,355,640
Roumania, 1873	27,388,310
Germany, 1879	70,815,706
Belgium, 1861–1871	28,781
Portugal, 1873	91,852,000
Switzerland, 1879	31,680,000
Italy, 1880	716,404,497
France, 1880	896,263,024
Spain, 1881	1,584,000,000
Greece	39,600,000
Turkey	158,400,000
Russia	17,160,000
Grape growing Atlantic Islands	7,920,000
Australia, 1878	2,193,048
United States	23,453,827

This shows what might to some have appeared almost incredible that our country, even in this production, does not foot the list. It is another feather in the cap of our national pride, that is now destined to increase in volume until even the most favored wine-producing countries may not be ashamed to acknowledge us a rival.

There are many ways by which the improvement of our wine production might be attained; but that with which we propose to deal at this time is involved in the operations of vineyard culture rather than the cellar management, even though it has an indirect bearing upon the latter, and though there may be applied to the treatment of the must and wine in American cellars many standard principles of European practice not familiar there, and which could not fail to make an impress upon the products that would be strongly felt in the favor with which they would be received. I do not mean to intimate that the average American wine-maker is deficient in the knowledge necessary to the production of good wine, for that would justly be set down as rank treason, and it certainly would be unfair, for it is by no means difficult to obtain in almost any section of our country wines of which we have no need to be ashamed, but it can scarcely be denied that a wider knowledge of the principles and practices to which we have referred, and their wider application in the ordinary work, would do much to reduce the not unfrequent complaint of bad products coming from the consumer, and of unprofitable results coming from the producer.

The principle that continued cropping will eventually result in disastrous exhaustion, if no means be taken to supply the waste, is quite as applicable to the grape as to any other crop, and deficient nutrition will deplete the vine, decrease its products, and place it in condition to succumb to the attacks of disease just as surely as poor food and bad treatment will break down the constitution and ruin the character of the best breed of cattle or the thoroughbred horse, while injudicious nourishment will, on the other hand, just as surely tend to the development of those qualities of increased size, extensive leaf and wood production, to the exclusion of fruit production, and to the production of thin watery and acid juices rather than the more desirable sweet ones. We shall therefore endeavor to show what shall be the character of the nutrition for the attainment of the end we have have in view and the quantity in which it should be applied to the vine.

The question of nutrition in vineyard culture, as, indeed, in most other cultures, in this country, has received less careful consideration and study and has been less a subject of practical experiment in this country than in Europe. Here the stronger and more prolific varieties grown and the greater naturally fertile character of our comparatively virgin soils have never made it a matter of such pressing necessity and question of rigid economy as it has become to the vintners of the old world, and this, together with the natural indifference of our people to the importance of such relations as must arise in this connection, may be accepted as causes of the general negligence of this part of agricultural economy. But the necessity that aroused the European agriculturists is now being felt in many parts of our country, especially in the Eastern States, and we are therefore constrained to believe that the facts we are able to present will receive at the hands of our vintners the consideration that their importance and value deserve.

The value of chemical analyses of the soil as they are usually made may justly be doubted for application in the study of the nutrition of the vine as well as in the nutrition of other crops. The reasons for this are manifest. In chemistry it is well known that the action of solvents is more ready and more effectual when the material to be acted upon is reduced to the finest possible state of division, and what is true in the laboratory practice applies to a large extent in the operations constantly being carried on in the soil. The natural solvents of the soil are necessarily weak in their action, and they must be most efficient in those soils where the largest quantity of finer particles prevail. The coarser particles which yield to the action of the stronger acids in chemical analyses, and give up the elements of mineral nutrition, resist almost completely the action of natural solvents and so much of these elements as are held by the coarser particles that must prevail in good, open, mellow soils, must consequently be unavailable in the growth and nutrition of the plant. This holds good in all cultures, but it has been made especially evident by Dr. Blankenhorn, in his studies of the composition of good vineyard soil in Germany. Thus taking the result of his analyses and calculating the quantity that would occur in a stratum one foot deep, he obtained figures corresponding with the following, in pounds per acre, showing the most important constituents present:

Thus he found of potash 4,826 pounds per acre; of soda, 2,768 pounds per acre; of lime, 25,381 pounds per acre; phosphoric acid, 884 pounds per acre; while if the same soil were treated to separate very fine particles, a stratum one foot in depth would yield but 48,382 pounds per acre, yielding, when subjected to the action of solvents approximating in intensity those of the soil, but 22 pounds of potash and 365 pounds of phosphoric acid. The crops of the vineyard represented are said to be small, and it is scarcely a matter of surprise.

In the study of the nutrition of the vine we are, from the nature of the case, compelled to confine ourselves to a study of the constituents of the plant and its parts, produced under the varying conditions and its behavior under the influence of nutritive compounds of known composition. Fortunately these relations have, during the past few years, been the subject of careful study and of patient and laborious experiment in various parts of Europe, and their results may be accepted without reserve as a guide to practical work in any part of the world.

I shall begin with an examination of the quantities of the elements of mineral nutrition annually removed from the soil of the vineyard in the ordinary operations involved in the culture of the vine. This has been estimated by many investigators, and from their results it appears that a fixed rule with regard to it can scarcely be set down because of the wide differences that occur, dependent, doubtless, upon the widely differing conditions to which the vines employed in the investigation had been subject. I shall select as an example the results obtained by Professor Neubauer, both because he stands so high as an authority on grape culture and because of the thoroughness of his work. His investigations were made with vines of the Riesling grape, growing at the Oeno chemical experiment station at Weisbaden, in Germany, where the vines were planted at the rate of about five thousand per acre. He carefully collected all the materials removed in the annual operations of the culture and vintage, and made careful and detailed analyses of the mineral matters to determine the quantities of each constituent annually consumed; and while it would be impracticable to present here the details of the results of his analyses, it will be quite sufficient and more to the point to give the figures for the total quantities of the nutritive mineral principles removed. All the figures given refer to quantities or pounds per acre. While in American vineyards the number of vines per acre never reach the high rate found in Neubauer's vineyard, this will be compensated for in the more vigorous growth of our varieties, and the consequently larger product of wood. The figures referred to are as follows:

Products.	Mineral matters.	Potash.	Lime.	Magnesia.	Phosphoric acid.
4,656 pounds wood	59	.90	18.00	4.26	.780
4,269 pounds shoots	111	40.17	27.82	10.269	10.168
2,649 pounds marc	66	29.33	4.77	.360	7.048
56 pounds lees	5	3.75	4.53	.044	.499
627 gallons wine	15	9.63	1.188	.044	2.904
	256	21.88	52.231	16.613	28.349

In these figures, as in the results of analyses of the mineral matters of the vine, the potash content stands higher than any other, and thus led Ville to especially class the vine as a potash plant; but Joulie has shown that it is no more so than any other crop. Thus he calculated the relation existing between the phosphoric acid and the other constituents in the vine and other crops, and obtained the following figures:

	Phosphoric acid.	Potash.	Soda.	Lime.	Magnesia.
Vine	1	2.28	0.021	1.79	.46
Ripe wheat	1	1.28	....	.52	.36
Wheat in bloom	1	2.25	.305	1.18	.52
Potatoes (tubers)	1	3.30	.048	.12	.24
Beet roots	1	3.65	.725	.45	.63
Meadow hay	1	4.18	1.145	1.83	.80

This shows, however, that potash stands high in all crops, and why its application in most cases to the soil is attended with such beneficial results. In the majority of soils we find the phosphoric acid present in much larger quantity than the potash, while in the plant the relation is exactly reversed. It is therefore plain that phosphoric acid may be even in excess when the potash may be wanting. This is a point worth jotting down in our memories.

Nor is the vine by any means as exhausting to the soil as many other crops. Again quoting Joulie's figures, and confining ourselves to the potash and phosphoric acid, which are really the more important constituents in all cases, we find the following relation for the several crops named in whole numbers of pounds per acre:

Thus of phosphoric acid there is consumed in pounds per acre by the vine 9.74; by wheat, 28.8; by potatoes, 37.8; by beets, 48.9; by hay, 14.5; and of potash by the vine 21.1; by wheat, 35.77; by potatoes, 124.6; by beets, 178; by hay, 60.87.

A somewhat similar relation was worked out with sugar beets, wheat, potatoes, &c., though their observations were mainly confined to the relations between the more important constituents of the product—sugar and starch—and the more important constituents of the mineral compounds present; and the same or similar relations may prove of value in vineyard culture. They found that for a given quantity of starch in wheat and potatoes a given quantity of phosphoric acid, potash, &c., is taken up by the plant. They found that for the production of 100 pounds of sugar in the beet there were consumed in the development of the plant 1 to 1.20 pounds of phosphoric acid, 5 to 6 pounds of potash, 1.5 to 2 pounds of soda, 1.5 to 7 6 pounds of lime, 1.2 to 1.4 pounds of magnesia, 2.7 to 3.5, pounds of nitrogen.

They therefore concluded that in the formation of sugar in the beet the value of a given quantity of phosphoric acid is equivalent to six times that of the same quantity of potash. On the other hand, however, it shows the advantage to be attained in the application of potash salts in quantity to the crop.

If now we follow the method of Champion and Pellet and make calculation for the quantities of these several elements of mineral nutrition consumed by the vine in development as compared with the quantity of sugar produced in its fruit, we obtain figures which differ to a considerable extent from those obtained for the sugar beet

Thus, taking for data the results of the analyses of Peneau of the different parts of the vine growing at Fenestrelay, and the figures he gives represent the yield of must; then assuming 20 per cent. to represent the average sugar content of the must, we arrive at the following figures: that is, in the production of 100 pounds of sugar in the grape there must be consumed in the development of the vine 1.7 pounds of phosphoric acid, 19.2 pounds of lime, 3.2 pounds of magnesia, and 6.5 pounds of potash.

The figures for lime here appear abnormally high as compared with the figures for potash and the other constituents, and it is difficult to account for the difference except we assume that the vine grew in a soil exceedingly rich in lime and very poor in potash, when the plant exercised its power of substitution in the absorption of nutrition that it has been shown to possess. This supposition is supported by Peneau's analysis of the soil in question. However, if we make the same calculation on the basis of Neubauer's analyses, the results of which we have already given, we find the same difference in favor of magnesia. Thus, in this case, for 100 pounds of sugar we have a consumption of 2.98 pounds of phosphoric acid, 5.0 pounds of lime, 18.6 pounds of magnesia, and 10.29 pounds of potash.

Dael von Koeth's analyses would give 2.12 pounds phosphoric acid, 4.97 lime, and 6.2 potash.

These figures tend to show that, so far as the sugar content is concerned, the total quantity of nutritive elements consumed in its production is greater than for a corresponding quantity of sugar in the sugar beet. And though the vine does actually remove less nutritive material than other crops, this shows that it would probably remove more if it had the chance.

We see, then, that a very considerable quantity of such material is annually removed in the culture, and the question next naturally arising is how to replace it. What compounds may we apply to restore this material and at the same time stimulate the production of quantity and quality in the fruit? This is an important question, and we may bring the results of European experience to our aid in formulating our reply.

We have seen that an elevation of the proportion of the leading elements of mineral nutrition of the vine corresponds with a higher proportion of sugar in the fruit. It is also true that the same condition corresponds with a healthier condition of the vine. This is evident in the results of analyses made by Professor Foëx of the mineral matter of healthy and diseased vines growing in the neighborhood of Montpellier, in France. Thus he found the following percentages in the ash of the—

Constituents.	Leaves.		Wood.	
	Healthy vine.	Unhealthy vine.	Healthy vine.	Unhealthy vine.
Potash	13.02	5.29	32.20	16.42
Soda	1.07	.41	.49	.28
Lime	55.19	60.90	41.77	52.50
Magnesia	11.33	13.18	10.88	13.48
Phosphoric acid	3.63	2.89	6.32	5.85

And Schulze found in the raw material of the vine

Constitutents.	Leaves.		Wood.	
	Healthy vine.	Unhealthy vine.	Healthy vine.	Unhealthy vine.
Potash	1.08	.51	1.11	.56
Soda	.09	.04	.02	.01
Lime	4.59	5.88	1.44	1.78
Magnesia	.94	1.27	.37	.46

It would appear from this that it is potash that has the most marked influence upon the health of the vine. And Bechi, in his investigations at the agricultural school at Florence, in Italy, discovered that the quantity of potash found in the vines varies with the quantity available in the soil; that when potash is present in the soil in abundance it will be taken up in preference to other alkalies, and when this is wanting its place may to some extent be supplied by soda. Nessler's experiments also confirm it. He applied certain fertilizing compounds, and found in the vine the corresponding quantities of phosphoric acid, lime, and potash shown in the table.

Manure given each vine.	100 parts ash contained		
	Phosphoric acid.	Lime.	Potash.
None	9.21	27.9	16.87
30 grams gypsum	8.74	22.6	18.91
15 grams potassium chloride 15 grams ammonium sulphate 15 grams calcium phosphate	12.04	30.6	23.73

Audoynaud, recognizing the influence and value of potash salts in vine culture, made a series of experiments in 1875 and 1876 to determine in what compounds it is best suited to the vine and more readily taken up by it. He applied to different plots of vines the carbonate, nitrate, sulphate, and chloride, and from the results of his experiments and the location of the potash in the different parts of the vine he was led to conclude that—

1. The sulphate and the chloride of potassium have a marked influence upon the development of the vine, but the nitrate is superior to them and the carbonate inferior.

2. Weak vines seem to consume as much potash as vigorous ones.

3. An excess of nitrogenous matters is rather injurious than useful.

4. Potash should always enter into the composition of manure for the vine, that of the soil being generally in bad condition for assimilation. Potash in some way carries with it other fertilizing principles.

6. All potash introduced by the root in the course of a season is not entirely consumed, since after fruiting a considerable reserve is found in the wood and the cane.

The experiments of the late lamented Saint Pierre, of the agricultural school of Montpellier, are of especial value in this connection. He made experiments with different kinds of fertilizing materials to determine the relation between the quantity applied, its cost, and the quantity of fruit produced. From the results obtained in 1869, he concluded (1) that chemical manures are much better for the vine than stable manures, which were almost without effect; and (2) that among chemical manures those containing at the same time potash, phosphates, and lime gave the best results. Nitrogen alone is more injurious than useful, while non-nitrogenous manures gave very good crops. Among nitrogenous manures those containing small quantities of nitrogen gave better results than those containing larger quantities. Potash alone proved excellent, and whenever it was wanting the yield was bad.

From his results of 1870 he concluded that the best fertilizing material for the vine is a mixture of salts of potash and nitrates. (2.) Neutral or acid phosphates seem to have had but little influence upon the quantity of the crop. (3.) Nitrogen in the form of nitrates gave better results than when applied in the form of ammoniacal salts. So, also, Joulie found for the sugar beet, and it is doubtless of value for application here that for the production of sugar in the beet the nitrogen of nitrates is more valuable than that of ammonia, which in its turn is more valuable than that of organic origen, and especially of animal matter.

With regard to phosphoric acid in its relation to the fruit, though it may not increase its quantity, there is reason to believe that it improves its quality. The earlier investigations of Alibert led him to conclude that wines having a strong bouquet are richer in phosphoric acid than those having weaker bouquet, and his analyses convinced him that there was a direct relation between the proportion of phosphoric acid in the wine and its quality. Thus he found one-third more phosphoric acid in Reisling wine than in other varieties. So, also, Neubauer concluded, from his examination of grapes at different stages of growth, that the phosphoric acid and potash in the fruit increased with the increase of sugar and the diminution of acid. It has also been satisfactorily proven that phosphoric acid has a tendency to hasten the ripening of the grape.

So much for the value of the several elements of mineral nutrition and the development of the vine and its fruit. Now, what shall we use to supply them? In comparing Neubauer's figures for the quantities removed annually from an acre in vine culture and deduction made from his results of analyses of cow manure, the quantities of potash found in the former will correspond nearly with that found in 4 tons stable manure.

But in this quantity we find that of the other constituents there is an excess of what is required by the average crop, while of others there is a deficiency. The rational rule of practice would, therefore, be to reduce the quantity of stable manure applied to the amount necessary to supply that constituent required in smallest quantity, in this case phosphoric acid, and add to it the other constituents obtained from artificial and commercial sources. Thus 3 tons of cow manure could supply:

	Pounds.
Phosphoric acid	15.9
Potash	39.7
Lime	45.[illegible]
Magnesia	11 61

The potash should, as we have seen in the preceding pages, be added in the form of nitrate or sulphate of potassium. And this is really the only constituent that need be added to the manure. The soil of every vineyard should contain lime in abundance, and wherever it is wanting it should be applied in considerable quantities and at regular intervals, for besides furnishing what is necessary to the nutrition of the vine, and to some extent supplying deficiencies of potash and other alkalies, it has an exceedingly favorable influence upon the soil in correcting any deleterious acidity and improving its physical condition, and exercises a disintegrating action upon organic matters holding elements of nutrition in combination. Indeed we are of the opinion that its use in vineyard culture cannot be too strongly recommended, and that the application of 50 bushels per acre every three or five years will show a marked improvement both in the health of the vines and the quantity and quality of the crop Of course this quantity should be modified according to the quality of the soil under treatment, being reduced for sandy soils and increased for clay or loam soils.

The indications afforded in the facts we have presented will doubtless be found a sufficient guide for the vine grower in the matter of manuring his vines. But a few words more in this connection may prove of value. Reference has already been made to the prejudices prevailing abroad against the use of artificial manures for application to vines, because of the danger of changing the character of the wine produced, but careful study and observation by excellent authorities on the subject in Germany have shown that this has no foundation in experience. It is easy to imagine how proprietors of the highly celebrated vineyards, and whose products have from time immemorial almost enjoyed an exceptional reputation, and have consequently brought enormously high prices, should hesitate in introducing any changes in their methods of culture or the treatment of their soils, but for the producers of wine of ordinary quality the same causes do not obtain. They want good, strong, healthy vines, yielding large quantities with the best quality compatible with that yield. M. Saint Pierre has shown how the addition of various potash salts to the soil will increase the product, and we have seen also that the relations between the sugar content and mineral constituents of the vine are nearly constant. If these constituents be wanting then sugar must also be wanting. If they be applied to soils deficient in them the vine quickly responds in the production of sugar in the fruit. We have seen that for the absorption and assimilation of 2 to 3 pounds of phosphoric acid and 6 to 10 pounds of potash by the bearing vine under such circumstances as we have just described there should be a formation of one hundred pounds of sugar. Surely this should induce some reflection on the part of the vintner. The purchase of this quantity of sugar in the market to supply a deficiency involves an expense of $8 to $10 at least, while its production by the means suggested would involve a cost of only about one-tenth that amount. And who will for an instant question that the sugar produced is in every way superior for the production of good healthy wine?

The use of commercial sugar for addition to the must is entirely too prevalent in this country, and to it may without hesitation be ascribed, to a very considerable extent, the inferior quality and unhealthy character of many of our American wines. Let this practice of sugaring the must be abandoned, and the more rational one of applying suitable fertilizers to the vineyard adopted, and we may confidently predict for the near future a sounder product, wines healthier for the stomach and pleasanter to the palate, bringing profit to the producer and good-cheer to the consumer.

That the vine responds effectually as well as promptly to the application of fertilizers, both in quality and quantity of the product, is amply illustrated in the experience of Count de Gasparin in this connection.* To determine the comparative value of manure as applied to different crops, he treated a number of crops under observation with a given quantity of stable-manure having an average value of $2.60 per ton, and noted the quantity of the product of each crop resulting. From the excess of each over the quantity yielded by the average crop he calculated the money value of the influence of the manure applied in each case. The values he thus obtained were as follows:

For wheat	$1 86
For beets	2 88
For madder	4 38
For vines	9 20
For olives	9 60

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* Related by Petit Lafitte, in La Vigne dans le Bordelais, p. 375.

showing conclusively that the vine is more sensitive to the action of fertilizers than most other crops, and yields greater profit for the same consumption of material.

"In general, then we may offer as a rule for manuring a vineyard the following: Apply stable-manure at the rate of about 2 or 3 tons per acre, and supplement it with an annual application of 200 pounds of the mixture made according to this formula:

"

	Pounds
Sulphate of potash*	500
Nitrate of soda	500
Superphosphate of lime	500
Sulphate of lime	500

In the relations of fertilizers to wine culture the following points are particularly to be observed:

1. In the application of fertilizers to the vineyard some preference must be accorded to those which improve the physical condition of the soil and which may increase the quantity of the product without injury to its quality. To this end stable-manure should be used in limited quantities, and lime liberally applied to those soils wanting in it, and of a compact nature.
2. To improve the chemical composition of the soil, phosphates and potash salts are principally to be depended upon. If nitrogenous compounds be used great care must be observed, and the nitrates are greatly to be preferred. Generally none are needed.
3. It is preferable to apply stable-manures or others containing nitrogen and decomposing slowly, in the fall immediately after the vintage; and all manures should be distributed as far from the base of the vine as the system of planting will permit.
4. Apply manures whenever a deficiency of crop or a weakened or diseased condition of the vines appear to make it desirable. Continued removal of nutritive principles from the soil without their restoration, will bring about these conditions, and increased vigor of growth and profitable returns in fruit will surely follow liberal supplies of these principles. *It is more rational and more economical to apply fertilizers to the soil than to add sugar to the must when the quality of the latter needs improvement.* This should always be maintained as a ruling principle in grape culture for wine making.

The CHAIRMAN. This paper is open for discussion.

Mr. TAYLOR thought that the portion of the paper referring to the amount of fruit allowed to the bearing vines was incorrect. Some vine growers consider from eighteen to twenty pounds as much as the vine would bear. Suppose they were given a certain percentage of manure to eighteen pounds, and they bore a certain relation to each other? It is very certain if they were to allow double the quantity of grapes to the amount of manure stated, that there would be a deficiency in the amount they expected from them. I would like to know whether Dr. McMurtrie ever made an estimate of the quantities to be borne by the vines as compared with the amount of nutriment supplied to the soil. How much should be allowed to each vine in proportion?

Dr. MCMURTRIE. The relations between the quantity of the product and the nutrition of the vine were set forth in my paper. Saint Pierre's investigations showed most clearly that the quantity of the product varied with the quantity and quality of the fertilizer applied to the vine. In the section in which his experiments were made in the south of France, it is common to have yields of twelve to fourteen pounds of fruit per vine. But here the vines are planted from six to eight feet apart, and if the number of vines, per acre, be increased, the yield per vine must be correspondingly decreased.

Professor TAYLOR. If you will state the number customarily planted in France I will be obliged to you.

Dr. MCMURTRIE. The figures I gave in my paper indicate a yield of 625 gallons of wine per acre in Germany. In this case they were planted at the rate of 5,000 per acre. But that is very much closer than they are planted in most of the vineyards in France, except in the more northern sections. In the middle and south the distances range from three feet to seven feet. In the extreme north from one and a half to two and a half feet. In the middle and south the number, per acre, would, therefore, vary from 4,700 to 870, and in the south from 19,000 to 7,840.

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* The sulphate of potash may be replaced by good unleached wood-ashes.

The PRESIDENT. The convention will, I am sure, be glad to listen now to Professor Riley's paper upon the "Grafting of the vine."

Professor RILEY said that he would have much preferred to remain a listener, but inasmuch as he had been called upon at this juncture he would offer a few remarks upon the grafting of the grape-vine. We graft for various reasons. The apple is grafted on to one stock or another to perpetuate particular varieties. The pear on to quince for the same reason, and because it is hardier thus grafted. The cherry on to mahaleb, mazard, or mavello stock for similar reasons. It has not been very generally the custom to graft the grape-vine, because the beneficial effect has not been so noticeable. This, however, is due to the method of grafting, which has been almost uniformly below ground. With this method the graft soon makes its own roots. In the existence of the grape phylloxera and its work we have an additional incentive to grafting the grape-vine, and before I proceed further with this branch of the subject let me give you a brief sketch of this insect and its ravages.

This insect is interesting as offering an illustration of the difficulty that is often encountered in solving the problems that present themselves in economic entomology.

The insect exists both above and below ground, forming galls on the leaves and swellings on the roots.

There are several generations during the season of these virgin females, all of them laying eggs without the intervention of the male sex. As early as July there begin to appear, not in the galls but on the roots, pupæ, which are destined to produce winged females. These females fly through the air and deposit their eggs upon the under side of the leaves of the vines. From these eggs are hatched the individuals which are sexual; that is, males and females, and these individuals are, strange to say, perfect as soon as they hatch. The female, as soon as she is impregnated, deposits one large egg.

This egg is the only impregnated egg produced by the species, and passes the winter either in the ground or under the loose bark of the older canes. In the spring there hatches from it what may be called the stem mother, which begins anew the cycle of development in the species, and which may either settle on the root or upon the leaf forming either the galls or the swellings, as shown in the diagram before you.

The gall insect is comparatively inocuous, though some kinds of vines may be covered with the galls until they become defoliated, and this may go on from year to year without serious injury to the vine; but the root insect, unseen and unnoticed, and therefore less known to the grape-grower, acts very differently. It produces abnormal swellings of the rootlets, as shown on the diagram, which, in time, rot, and as the insects increase in numbers, the larger roots are finally affected, until at last the whole root system perishes. The outward effects are a yellowing and dwarfing of the growth, and soon death ensues. This is the disease that has attracted so much attention in France since 1869, and which was first called *pourridie* or rotting.

In 1871 I had the pleasure of proving by examination in France that the insect that was doing this injury was identical with that we have here, but which we knew only in the gall condition at that time. In returning from France I found that the root insect was at work here just as it was there. I discovered that this rotting of the roots was going on here through this cause, though hitherto unknown to our grape growers. I made a number of examinations in the field, which showed that our indigenous vines have a greater or less power of resisting the attacks of the insect according to their species. We find that our cultivated vines suffer according to their origin. The European vine—the *Vitis vinifera*—is more susceptible, and, whether east or west of the Rocky Mountains, it succumbs to its attacks. It matters little whether in California, Washington Territory, Missouri, or Ohio, wherever this insect occurs the European vine succumbs to its attacks, regardless of climate or other conditions.

I cannot, therefore, help believing, when these facts stare me in the face; when I know that vines that were considered thrifty, reliable vines ten or twenty years ago in this country, have since been abandoned, that it is not due to the climate alone, but very largely to the insidious workings of the Phylloxera. I do not in any way deny the injurious effects of mildew, and the difficulty of overcoming it, but I do maintain that it is but one cause of the failure of the European vine here, and that Phylloxera is another and still more potent cause of failure, though less easily observed and recognized. I cannot fully accept the remarks of Mr. Sargent, in his paper of this morning, that the Phylloxera is less injurious in California than in Europe; for if we are to depend upon the recent investigation of the State viticultural commission, there are the greatest reasons for fearing that it will continue to devastate the vineyards in every section of the State, as it already has done in the Napa and Sonoma valleys.

There is nothing more sure than that we have varieties which effectually resist the Phylloxera, and others which succumb in a varying degree, and that grafting the latter on the former furnishes us with one of the best preventives against the disease. Let me, therefore, come at once to the subject of grafting.

Mr. PORTER. Is this ability to resist owing to the vitality of the root to restore by renewed growth?

Professor RILEY. In some measure it is due to the greater vigor of the root-growth, which is characteristic of our indigenous species as compared with the European. There are many other explanations that may be offered, and which I have recorded in my writings on the subject. Among these I would mention the fact that the insect is indigenous to North America; that it has always existed here, and, on the principle known to naturalists as the survival of the fittest, our present native vines are those which have successfully resisted these attacks in past ages. The European vine, on the contrary, has not been accustomed to this trouble, and being more tender and highly developed, suffers more from it, very much on the principle that a disease is always more virulent when first introduced among peoples that have never before suffered from it. Again, in the devastated regions of Europe the vine is the principal plant cultivated, and the winged female, which disseminates the disease through the air, has consequently no difficulty in finding vines on which to lay her few eggs; whereas, with us, our vineyards being scattered, a large proportion of such winged females will perish by settling on intervening crops and forests.

It must be patent to you all that in order to avoid the injury of the insect that attacks the roots, and to which I have just referred, the grafting must be done in such a manner that the stock chosen for this resisting power will retain its influence upon the graft by retaining its roots. The advantages of grafting the grape are so manifold, even putting the Phylloxera out of the question, that the subject is well worthy of our consideration. New and rare varieties are easily increased and untried varieties easily tested, while worthless varieties are readily changed to desirable ones. It is important to bear in mind in this connection that the grape vine, having a very thin inner bark or liber, does not graft with the same ease as do many of our common fruit trees, and that more care is therefore necessary in the process.

I now take the liberty of reading from some of my previous writings on this subject; the more willingly that Mr. Husmann, in the recent edition of his work on grapes and wine making, does me the honor to quote the remarks in full.

> Cleft grafting is the more ordinary mode employed, and it is usually done by digging away the earth, and inserting the graft very early in the spring, 2 or 3 inches or at the first smooth place below the surface. A horizontal cut of the stock is generally made, but a sloping one is, perhaps, preferable, from the fact that it enables all the gummy matter and excessive moisture which oozes from the cut to run down, and not accumulate to the injury of the cion. Fuller recommends grafting in the fall, and while this method is not deemed so advisable in Mississippi Valley, where there is such continued alternation of freezing and thawing, which is apt to lift the cion and separate it from the stock; yet it may elsewhere be followed profitably.

But valuable above all other experience is, perhaps, that of Mr. George Husmann, and I take pleasure in giving that experience, as he has kindly communicated it to me:

> DEAR SIR: As you wish to have my views of grafting the vine, especially with the object of grafting some of our varieties most subject to the ravages of the Phylloxera upon roots of varieties which resist it, I will cheerfully add my mite to the researches which have already thrown so much light upon the history and the failure of so many of our otherwise most valuable varieties. My first attempts at grafting the vine were made in the spring of 1852, nearly 30 years since, and were made by grafting the then rare varieties of Norton's Virginia and Herbemont upon five-year old Isabella roots. I found in the first edition of A. J. Downing's "Fruits and Fruit Trees of America," a few remarks on the practicability of grafting the grape below the ground, which led me, then a novice in horticulture, to try it, and with eminent success. I took the ground away from the crown of the vine until I came to a smooth place, then cut off the stock, split it with a grafting chisel and inserted from one to two cions, according to size of stock, cut to a long wedge with shoulders on each side. I used no bandages, as the stocks were strong enough to hold the cions firmly, and only pressed moist earth on the cut to cover the wound. This was done on the 22d and 23d of March, and the cion covered and shaded to the top bud. About three-fourths of the grafts grew vigorously and fruited the next year. They have produced heavy crops ever since, and some years since I still found them vigorous and healthy, while the Catawbas around them have "passed away" several years ago. I have practiced various methods since, with more or less success, and still think this the best and most practicable, though it is neither an easy nor a pleasant task, as it must be performed when the ground is still cold and moist, and requires a good deal of stooping. The success of the operation depends entirely on a good junction of the liber of stock and cion, and therefore requires a steady hand and a good eye to push the cion to its place. My friends, the venerable Fr. Muench and Samuel Miller, practice about the same method, and are both almost invariably successful. The cions should, if possible, be cut in fall and kept on the north side of a building or fence, so as to remain dormant. Should the stock not be strong enough to hold the cion firmly, it should be tied with basswood bark, or an oblique cut be made instead of a split. This is preferable in small vines anyway, as by so doing the fibers of stock and cions are both cut obliquely, and therefore make a closer fit.
>
> There are other different methods. Another, which I will mention here, has been practiced at Hermann with very good success, though I have not been very successful with it. It has the advantage of saving the vine provided the graft does not take. It is done by simply making an oblique cut into the stock below the surface or crown, and inserting the cion, cut to a rather blunt wedge, by bending the stock to one side, and thereby opening the cut. If the cion takes, the stock is cut off above it. Another method is grafting under the bark later in the season, when the sap flows freely and the bark peels readily; a long, slanting cut is made on one side of the cion, the stock cut off square, the bark lifted with a knife, and the cion pushed down under it. Every one who has practiced budding will readily perform this operation. The stock is

then tied with basswood bark. I have followed this plan with varied success later in the season, but prefer the first method.

GEO. HUSMANN.

SEDALIA, MO., *December* 20, 1874.

It will be noticed that the above experience and directions refer solely to grafting underground. Both Fuller and Husmann deem grafting above ground impracticable in our climate, principally on account of our winds; and their advice has been so very generally followed that little attention has been given to this mode of grafting the grape vine. The consequence is that we have the most conflicting experience as to the results of grafting; for, by the underground methods, the graft will make its own roots in the course of a few years, unless very great pains are taken to prevent such an occurrence; that it has done so in the majority of cases of grafting in this country in the past, admits, I think, of little doubt. Yet, in grafting as a means of counteracting the Phylloxera, the first requisite is to prevent the graft from making any roots of its own; for it must be remembered that we are dealing with a root malady purely, and that the object is to grow those varieties whose roots succumb more or less to the attacks of the insect, by using the roots of those which resist; this object is necessarily frustrated in proportion as the graft forms roots of its own.

There are two methods of grafting above ground, which I have every reason to believe may be made more successful than grape growers have hitherto been led to suppose. The first is by temporarily making a false surface and grafting in the ordinary manner just described, *i. e.*, instead of digging away the earth and inserting the cion two or three inches below ground, it should be inserted two or three inches above ground and the earth thrown up around it, to be removed only after the graft is thoroughly and permanently joined. There will then be no danger of the graft forming its own roots; and it is certainly as easy to throw the earth around the vine as to dig it away, while the mechanical work can be much more conveniently and agreeably performed above than beneath the surface. No doubt this mode of grafting needs greater care to make it successful, especially in a very dry season, as the mound is more apt to dry out than the level ground. Yet there is not lacking evidence that this method will work well in our soil and climate. Mr. John Vallet, of New Haven, a grape-grower of much experience, has had eminent success in thus grafting above ground, employing flax twine and paw-paw bark for bandaging. He considers that the vine grows more vigorously and that there is less danger of separating the graft when once formed, as there is no necessity for going below ground to destroy the suckers, the doing of which sometimes loosens the graft.

The second method is by inarching. This system of grafting does not seem to have been much practiced in this country, yet while it requires great care, and success may not as often crown the effort as in the former methods, I hope more attention will in future be given to it.

The operation is comparatively simple: A slice 2 or 3 inches long is cut from one side of the vine to be grafted, and a similar slice from the vine which is to serve as stock, as near the base or butt as possible. The two cut portions are then brought face to face, so as to fit as neatly as possible, and are then bound together with cord, basswood bark or other grafting bandage, which should be kept moist with moss. In the course of a fortnight partial unison takes place, when the bandage should be somewhat loosened to admit the expansion. In six or eight weeks, if the operation is successful, the stock and cion are firmly united, when the bandage may be removed. The graft immediately below the union and the stock immediately above it should then be partially severed, and in a week or so more entirely cut loose.

While, as already stated, this mode has not been much practiced in America, sufficiently successful results have been obtained to encourage further trial; and, as an example, I will mention one instructive instance communicated by my friend Isidor Bush. One of his customers, Eugene Cambre, of Nauvoo, Ill., has for some time furnished him with a superior quality of Delaware wine; and being anxious to know how Mr. Cambre succeeded so well with the Delaware, when so many others in the same neighborhood failed with it, Mr. Bush inquired as to the reason, and found that it was Mr. Cambre's custom in planting a Delaware vineyard to plant alternately with a Delaware a wild vine from the woods, and to subsequently transfer the Delaware on to the roots of the wildling, by this system of inarching.

The Delaware is among those which suffer materially from the Phylloxera, and several other cases of its successful growth when grafted on to wild vines, where on its own roots it failed, are on record.

Mr. Cambre's method is as follows:

For this method it is desirable that two plants, one each of the variety which is to form the stock and one of the scion, be planted close together, say about one foot apart. In June (the first year, if the plants make a sufficiently strong growth; if not, the second year), or as soon as the young shoots become sufficiently hard and woody to bear the knife, a shoot is taken from both the stock and the scion vine, and at a convenient place, where they may be brought in contact, a shaving is taken out from each of these, on the side next to the other, for a length of 2 to 3 inches. This must be done with a smooth cut of a sharp knife, a little deeper than the inner bark, so as to obtain on each a flat surface. They are then fitted snugly together, so that the inner bark joins as much as possible, and wrapped securely with some old calico torn in strips or soft bass strings. Besides this, it is well to place one tie a little below and one above the grafted point, and also to tie the united canes to a stake or trellis to insure against all chances of loosening by the swaying of the wind. The rapid swelling of the young growth at this period of the year makes it desirable that the grafts be looked over after a few weeks, replacing such ties which may have burst, and loosening others which may bind so as to cut into the wood. A union will generally be made in the course of two or three weeks, which will be further consolidated in the course of six to eight weeks, when the bandages may be removed and the grafted portion left exposed to the sun, to thoroughly harden and ripen it. The shoots themselves are to be left to grow undisturbed for the rest of the season. In the fall, if a good union has taken place, the cane forming the scion is cut close *below* its union with the stock cane, which in its turn is cut close *above* the connection. Supposing the stock to have been a Concord and the scion a Delaware, we now have a vine of the latter entirely on the strong, vigorous root of the former. Of course constant vigilance must be exercised to prevent suckers from starting out of the stock. It is well to protect the grafted joint the first few winters by a slight covering of straw or soil to prevent frost from splitting it apart.

Mr. Cambre, in giving his experience, writes: "I have positively abandoned cleft grafting; it is too much trouble and too uncertain, and the graft often makes its own roots. I assure you that from a long experience in inarching I am of the opinion that not alone the Delaware, but most of our cultivated varieties will do better on native wild roots than on their own. I have 14 acres of vines, mostly grafted in this manner on wild stocks, and I have not lost one of such grafts. It is preferable to graft at from 10 to 15 inches from the ground."

Another mode of grafting above ground is thus given in "The Cultivation of the Grape," by W. C. Strong:

In The Gardeners' Monthly, Vol. II, p. 347, is a description of a mode practiced with success by Mr. Cornelius, which we copy, not merely as it is interesting in itself, but also because it illustrates many other modifications in grafting:

After the first four or five leaves are formed, and the sap is flowing, you choose the place on the vine where you intend to graft. At that point wrap tightly a twine several times around the vine. This will, in a measure, prevent the return sap.

Below the ligature make a sloping cut down; also, a similar reversed one above the ligature, about one inch in length. In selecting a scion prefer one that has naturally a bend. Cut it so that it shall be wedge-shaped at both ends, and a little longer than the distance between the cuts in the vine. Insert the scion, taking care to have the barks in direct contact, securing it with a string, *c*, bound round both scion and vine sufficiently tight to force the scion ends into their places. If the work is done well no tie will be required at *a* and *b*, but the joints should be covered with grafting wax. In a short time the bud will commence its growth, after which you can by degrees remove all the growing shoots not belonging to the scion, and in course of the summer you may cut off the wood above the bud, and in the fall remove all above *a* on the stock and above *c* on the scion.

Still another mode of grafting, which has, I believe, seldom, if ever, been attempted in America, but which has been employed with much satisfaction in France, and especially by M. H. Bouschet, of Montpellier, remains to be mentioned. It is the winter grafting of a cutting of such variety as is desired to grow, upon another which is to be used as stock, the combined cuttings being planted in the usual manner in spring, leaving only the buds on the graft proper out of ground. This is very similar to our ordinary mode of making apple grafts; and while we have little or no experience in this country on which to base anticipations, the method is worthy of trial, and is illustrated at figure 21.

Mr. **Peffer** had had the Phylloxera in his vineyard several times in twenty years, and he found that the cold weather killed the eggs. The Clinton was most affected, and others that had smooth leaves. Those that have leaves with fur on the under side never had them. The Delaware was once affected, but that was on its own root. The Rogers was once affected with it, but it was not touched the next year.

A long and unimportant discussion on the subject of grafting followed, interspersed with remarks on the business to be brought before the convention to-morrow.

No new facts were elicited, and the report is therefore omitted from this record.

The convention adjourned at 5.25.

WEDNESDAY, *January* 18.

The convention was called to order at 10.52.

The PRESIDENT. The question of horticulture and wine making is still before the convention. Mr. Saunders, who has charge of the horticultural division of the department, will address the convention upon that subject, and I will leave the convention in his hands for the present.

Mr. SAUNDERS. I shall not take up the time of the convention with any extended address. I propose to make a few remarks upon this subject somewhat desultory in their character, and I perhaps may better illustrate what I wish to say by a supposition. We will suppose that we select twelve or any number of native grapes. We may have one or two foreign grapes, also, if you please. We plant them side by side here in Washington, or anywhere else, and watch their progress.

We will find that as summer advances and growth goes on that some of these grapes are making fine growth, ripening their wood, and presenting a perfectly healthful fine foliage. The next grape alongside has done tolerably well until the middle of July, when the leaves have become spotted. It continues to grow worse, until toward the end of August, when there is not a leaf left. Some will be robust while others will be the reverse.

Now the next year we prune these vines; we find that those that lost the leaves early last summer come along weakly the following spring, and if the season is favorable to this condition of leaf blight, we will find it is generally fatal; others will exist for years while a few will come on, keep robust, and do well. We will suppose as we go along, and I will not suppose anything that I have not actually seen, that one of the branches of a vine that lost its foliage in this way catches into a tree. We will find that that portion of that vine will retain its foliage well, while it goes on and ripens its wood the same as the strongest, whereas a branch of the same vine trained to a trellis goes on as before, the leaves become yellow and diseased, and the vine droops and fails to mature. Now, these are conditions which we find ordinarily, though sometimes there is great loss before we find out which it will be well to plant. There seems to be nothing in the plant itself which will indicate whether it is to do well or not. Now, suppose that we endeavor to grow artificially what we have seen in the tree. We will cover our trellis with a board sixteen inches wide, and we will find that underneath that cover that the grape does much better even with this slight protection than it does when not so protected. This teaches us that we may construct a covered trellis on purpose to grow grapes. I have seen them constructed so that the average width was about 24 inches with a trellis underneath, and with such a device all of your grapes will be found healthy, and your foreign grapes will do fairly well, even in this climate, with just such a protection.

Now we begin to ask the philosophy of this. We will take two registering thermometers, hanging one underneath this cover and the other one in the exposed area, say three feet from it. We look at them on a bright July morning after a clear night and we find that the exposed thermometer has been down eight degrees—I have seen it ten—eight degrees lower than the one that has been protected under the cover. We begin then to see that the cover arrests the radiation of heat; that it is arrested in its upward course, and no dew is condensed. We find a plant alongside this thermometer dripping with dew, and in a few days sometimes, under these conditions, we will find that the leaves of this exposed part are becoming blighted, and in a few weeks they are gone. What does this teach us? That the injury is caused by dew. Now let us extend our views a little over the country. We find that what we have seen in this little experimental patch is being repeated only on a larger scale. That there are portions of the country where all grapes do well, and portions where those grapes do well that resist any inclemency of the weather, and these few thrive almost anywhere in the country; but we find, as I said before, a special locality where they do especially well, and that is the locality where there is little or no dew. That is the whole story about grape mildew, and I do not wish to take up the time of the meeting on this point. I think myself the question is a very important one, and I have mentioned it only to show that all of the diseases of the grape, all of its casualties, all of the reasons why we cannot grow certain grapes, are not owing to an insect either at the roots or anywhere else. In this connection I can perhaps best express my opinion by reading from an article I prepared some seven years ago upon this subject:

For several years past considerable attention has been given to the grape-root insect, and the injuries it inflicts upon vineyards, both in this country and in Europe. Its life-history appears to have been thoroughly studied; its curious and somewhat perplexing transformations have been elaborately explained by entomologists of both continents, and its destructive capacities duly chronicled.

Grape growers possess their full share of that propensity in mankind which is manifested in the tendency to shift responsibilities; and all failures in grape-culture, with but little of hesitation, are freely and willingly attributed to this diminutive insect. Unless we ignore an almost overwhelming amount of clear and direct evidence, it cannot for a moment be doubted that the Phylloxera has worked great devastation and caused great losses; but when it is asserted that all failures in grape-culture in this country are traceable to its ravages, it then becomes apparent that the insect is falsely accused, and that the assertion conveys a flagrant error, for which there is no intelligent excuse.

It has been distinctly stated that the failure of the European grape in this country is owing to the ravages of the Phylloxera. With as much truth the statement may be made that the failure of the orange-tree on the slopes of the Adirondacks is due to the presence of this insect.

The true cause of the failure of the foreign grape in ordinary field culture is now so fully understood, that it seems almost superfluous to state that it is solely due to atmospheric influences, as is clearly shown by its successful culture in glass structures in all parts of the country.

In the spring of 1863 a purposely-rude glass structure was erected in the garden of the department for the purpose of illustrating the cause and effects of mildew on the grape-vine. The appearance of this structure will be best understood by supposing an inclosure made by placing a few glazed sashes against a common board fence. A collection of grapes, comprising both native and foreign varieties, were planted two feet from and parallel with the front of the house. In due time two stems were procured from each plant, one of them being introduced under the glass roof and the other trained to an upright trellis set four feet from the front, fully exposed to the atmosphere. This arrangement was maintained for seven years, during which time the branches under the glass cover remained in perfect health and annually produced crops of well-ripened fruit. On the other side, the branches on the exposed trellis, with the single exception of the Concord, were more or less injured by mildew each season. The Iona branch under cover produced branches so perfect, both in size and quality of fruit, as to suggest a recommendation for its culture under glass, as published on page 25 of the annual report of the department for the year 1867. The branch of this vine on the exposed trellis never ripened a berry, and after struggling for a few years against mildew, the loss of foliage during summer, and the destruction of unripened wood during winter, it ultimately succumbed.

The foreign varieties, Black Hamburgh, Black Prince, and White Frontignac, shared the same fate, only more rapidly. Among natives, the Rebecca, Maxatawny, and Delaware, on the trellis, occasionally ripened a few branches, accordingly as mildew more of less prevailed, while the protected branches never failed to ripen perfect fruit. Occasionally the position of some of the branches were reversed, the inside branch withdrawn and fastened to the outer trellis, and its place in the house given to the branch it displaced on the trellis, and the result was in all instances alike. These are not isolated experiments. Horticultural literature is replete with corroborative evidence of a similar nature, and if the history of every vineyard in America could be minutely recorded, it would be found that success followed immunity from mildew, (or leaf blights, as some prefer to term it), or fungoid diseases in either form, and that failures as surely followed their presence; and the statement is not presumed to be made that this intermittent action was due to the erratic movements of Phylloxera.

Neither will the claim be seriously entertained that this insect exercises an influence in promoting the health of vines when their foliage is pro·ected, either by a glazed or a boarded covering; that the resulting loss of foliage, disease, and weakness, when the covering is removed, is caused by their active presence, and that they again abandon the plant, and permit it to assume health and vigor when the protective cover is replaced; if so, then the much-sought-for and highly-valued remedy for the Phylloxera is readily obtained.

The fact that the Phylloxera is found on the roots of sickly or dying grape-vines is not to be taken as conclusive evidence that the destruction of the plant is solely the work of the insect, since the presence of insects upon diseased organisms is of common occurrence both in animal and vegetable life.

It is a significant fact that, if we compare the list of varieties said to be least affected by the Phylloxera with the list of varieties least subject to mildew, we will find them to be identical.

The sum of the whole matter, then, appears to be this: that when a grape-vine becomes weakened from successive yearly attacks of mildew, destroying the foliage, so that the wood or shoots fail to thoroughly mature their growth, its vitality is so impaired that what little of life remains is easily vanquished by the Phylloxera.

It has been recommended to graft the Iona, Delaware, Catawba, and other varieties infested with the root-louse on roots of the Clinton, Oporto, Concord, and other kinds that resist its attacks, as a means of securing immunity from its ravages. It may safely be predicted that the results expected will not be realized. The same causes that rendered the Iona unprofitable on its own roots will render it unprofitable when grafted on the roots of the Clinton; and it would not be at all surprising if the then weakened roots of the usually robust Clinton be found badly infested with the Phylloxera.

If this method of grafting had proved successful, our vineyards would be planted with the most esteemed grapes of the world; but the experiment has often been made and as often failed.

If we look into the history of European grape-culture during the past thirty years, we learn that previous to the year 1846 the crops were satisfactory and the wine-producing interest prosperous. In that year the grape-mildew made its appearance near Paris, and soon spread over vineyards in neighboring districts, from whence it traveled with great rapidity over the south of France, Italy, and Hungary. In 1851, it had crossed the Mediterranean, invading Algeria, Syria, and Asia Minor, destroying the wine-commerce, and bringing ruin to the owners of vineyards. In 1852, it appeared in Maderia, and worked such devastation, that in 1856, only 200 pipes of wine were produced as against 14,000 pipes produced in 1850 in that island.

The losses incurred and the destruction occasioned to vineyards by this malady were beyond calculation; thousands of acres were abandoned, and in those not utterly destroyed the vines were weakened by the disease and produced only inferior crops. About the year 1863, it was discovered that the roots of diseased vines were covered with excrescences, and continued observations proved that this malady was increasing with fatal rapidity.

In 1868 a memoir was presented to the French Academy, detailing a new disease, which, the writer thought, was "likely to prove more disastrous than the mildew. This new enemy was an insect, a minute *aphide*, which formed yellow parasitic patches on the roots of the grape-vine." This "new enemy" has since received the name of *Phylloxera vastatrix*.

The warty, knotty processes, now so familiarly known as indicating the presence of Phylloxera, are not by any means a modern production. They have long been observed on the roots of grapes; but it is only when the plants are otherwise diseased and their normal vitality impaired that the insects prevail to a fatal extent.

Various kinds of *aphides* have existed on the roots of plants from time immemorial.

If, as maintained by most entomologists, the leaf-gall-producing insect and the root-louse are identical, it further confirms the accuracy of the foregoing observations and deductions. Among all the varieties of grapes, native or foreign, that have come under observation, I do not recall to mind any one kind that has been so frequently or so severely attacked by the leaf-gall insect as the Clinton. But this variety is so healthy, so exempt from fungoid diseases, that all attempts of the insect to fatally injure its roots are abortive; a result that may be expected of all other varieties so long as they retain a similarly healthy condition.

MR. SAUNDERS said that there are two very distinct kinds of mildew, one caused by too much dryness, the other by too much dampness. We rarely have our native grapes injured by the aridity of the atmosphere; but in those climates, like England and Holland, the upper surface of the leaf is frequently covered with a white, mealy deposit. That is the reason we cannot extend our season. We see it occasionally on the foreign grape, in the early part of the season; later, the foreign grapes are covered with this mealy deposit which produce the spores in the fall, injuring them still more. The causes which produce it are thought to be sudden changes. He had brought it on. He had taken a peach tree out in the cold, and then put it in a hot-house, and a blister would commence to appear in a few days. This has been attributed to insects, but the blistered leaves are found as often without the insects.

Mr. **CUTLER**, of New York, had visited Hampton Court palace, and was shown an old grape-vine that had existed one hundred years, upon which was a good supply of fruit, and over which they kept glass.

Professor **RILEY** said that no one could appreciate more than he the soundness of most everything that Mr. Saunders had said in relation to grape culture, the needs of the grape, and the peculiar atmospheric conditions under which the grape will most successfully grow. He wished, however, to disabuse the minds of the convention of the idea which Mr. Saunders' remarks may have led it to entertain, that all diseases of the vine have been attributed by himself to Phylloxera. Mr. Saunders knew very well that he, more than any other entomologist, had protested against the inclination. Mr. Saunders had not touched the vital point that he makes, viz., that the Phylloxera was a factor in the failure of many of our grape-vines. He was aware that few could appreciate the injury that the insect is capable of, who have not followed it around from vine to vine and from vineyard to vineyard, year after year, as he had done.

Professor Riley indorsed all that Mr. Saunders said about the effect of climate upon different species; but the varieties that fail ordinarily in a good climate do well in this latitude. The reason why a vine will not succumb during the first year's growth is, because it takes two or three years for the Phylloxera to attain injurious proportions. Many of our varieties which have failed would do well if you could keep the Phylloxera from them. The whole family of plant lice to which this belongs feed upon vigorous, thrifty plants, and not upon diseased or decayed plants.

Dr. **MCMURTRIE** said that he had long been of the opinion that anything that will have a tendency in any way to weaken the vine will give an opportunity for the attacks of disease upon it, and whether it be the Phylloxera upon the root, the insects upon the vines or the leaves, or whether it be deficient nutrition of the vine, or whether it be excessive radiation of heat from the vine during the summer nights to interrupt the vegetative process—any of these things will give an opportunity for the attacks of blight or mildew, to which the leaves are subject, and they will be more likely to succumb. I think it may be stated as a fact that those varieties which are the most vigorous, which produce the best and strongest leaf growth, are less subject to attacks of disease than other varieties. It has been found in the south of France that certain varieties of American vines are less subject to attacks of Phylloxera than others, and if we take the results of observations made there with regard to the likelihood of the different varieties to succumb to attacks of Phylloxera, we find that the weaker varieties with this regard are generally those with which we have most trouble from blight and mildew. It is true, as Professor Riley says, that the Phylloxera acting upon these varieties may have a tendency to so weaken the vines as to subject them to disease.

In the nutrition of the vine Dr. McMurtrie thought that the question of the soil had a great deal to do with attacks of disease. We hear statements of a vine's bearing four, five, or six years, and then being attacked by mildew or blight; but, at the same time, we hear nothing of supplying the nutrition of the vine by the application of suitable fertilizers. Vines starting out and bearing heavily at first exhaust the soil, which, in lands generally selected for vineyards, is not over rich, and this exhaustion indirectly weakens them and makes them liable to disease. He thought this might be largely remedied by the application to the soil of such elements as are found to stimulate the vine. In an experiment in 1877, which he had never had the opportunity to complete, he found that if the plant was supplied with mineral nutrition annually and brought up to a certain stage, and then the nutrition taken away, the plant immediately went into a weakened condition, and all sorts of molds were found on its leaves at once, whereas plants right alongside in boxes submitted to the same conditions, and having the necessary nutrition, were not affected at all. From the fact that we found that vines will run along four, five, or six years, and then succumb all at once, he believed that this effect of nutrition might be considered as an important factor in the question of diseases, another point which we cannot avoid. Mr. Saunders had called attention to the fact that radiation being interrupted produced good effects; there is no doubt but that is also an important factor.

Mr. **Porter**, of Virginia, agreed with the last speaker. In Virginia a gentleman had made as high as $1,100 to the acre. He had succeeded in ripening the Delaware by practicing restoration by nutrition. He practiced the cutting back of his grapes, allowing them to go out of bearing for awhile. He does not allow the production to exceed five pounds. He plants twice as many to the acre. One of the largest planters there now plants 4×6, the usual number being 8×8; he don't intend to produce over 2½ pounds to the vine. He was not a believer in excessive production. He had seen vines with a half a bushel upon them, but not a single cluster of perfectly ripe grapes among them.

Mr. **Porter**. Is there any evidence at all that Phylloxera did not exist or was not known to exist before its ravages were known in Europe? It was stated on yesterday that they have always existed here.

Professor **Riley**. In regard to the existence of the Phylloxera in Europe, we have very full evidence on that point, for the reason that the disease is conceded to have originated in those localities in France where the American vines have been introduced. In Europe it has spread from such centers of infection. There is no evidence of the disease having ever existed there before the time Mr. Saunders mentioned, but during the decade between 1860 and 1870, or a little prior, it was first introduced into France, as far as we have any positive record. There is no evidence to show that it existed on the wild vines or the cultivated vines of Europe, for the reason that I have shown. On the contrary, we have the most absolute evidence of its existence in America very early in the history of grape culture. The insect is, in short, indigenous here.

Mr. **Daniels** wanted to hear from those interested in the actual growing of vines, who have made it a business; what their experience has been; what vines they have planted, and what practical results they have produced. A discussion of this character will clear up the difficulties in the way of ascertaining and preventing the causes of the failure of the vine. The speaker gave an account of his own experience. In one case he had a gravel soil, one acre or so; he set it out with insufficient manuring, and every variety failed that he planted. He put in plows and tore it up, and put in a bushel of good compost with good results. Several varieties that could not grow in other parts of his place with less culture and less rich manuring succeeded well here. There every variety grew to advantage. When the dry time came they continued to get a magnificent growth. He then set out some Black Hamburgs with a similar result. This matter of nutrition is the prime factor in successful grape growing.

A Delegate who followed, said that he was more inclined to accept Mr. Saunders's theory, that the atmosphere had much to do with this question; that he had noticed that a succession of north wind, sunshine, and rain affected his vines. It was his observation if his crop passed the 22d or 25th of June it was safe.

Mr. DANIELS understood that Dr. McMurtrie holds that the injury does not arise from overbearing, and that if we properly feed, we can allow them to bear as much as they can.

Dr. McMURTRIE. I simply wish to impress upon you the fact that the nutrition assists the vine in its work.

Mr. PORTER. To perform the work of overproduction.

Dr. McMURTRIE. Overproduction amounts to this. In all cases there must be in the fruit a fixed relation between the organic and the inorganic constituents. If the supplies of nutriment from the soil be sufficient to meet the demands of these relations, development of the fruit will proceed normally and with no interference with the conditions of development of the vine. The soil must contain the constituents suited, as well to the production of fruit as of wood and leaves. If the soil do not contain them, the fruit must draw upon other parts of the vine and exhaust not only the reserve held for its present development, but it may even be deprived of those needed for future use as well. Two remedies for the difficulty then become manifest. Either the quantity of fruit must be reduced or the nutriment required to normally bring it to maturity must be supplied from external sources. But if the soil can supply this nutriment, the vine will by no means become exhausted should these supplies cause a larger production of fruit. You cannot make a horse thin by work if you feed him well and properly.

Professor RILEY. I would say that probably a very strong argument against Mr. McMurtrie's position is that all the modes of nutrition, stimulating, cultivating, and manuring have not proved susceptible of accurate determination, though partly so. But nourishment, continually, while it will improve them, will not prevent the attacks of insects in the end. If only the bearing of the vine were in question, there could be a remedy. That is not the idea. I believe there are various causes producing the death of all vines, but in these cases we must recognize every separate character. Mildew is one and phylloxera is another, and they each have their definite characters and their definite appearance.

Mr. HEUSER said that, in regard to the rot, he planted three acres on one side of a line and three acres on the other side. The one side is rich and affords sufficient nutrition, and he planted that with Concords ten or twelve feet apart. They came up well. On the other side the soil was poor, and he manured heavily, and the growth was very small and it was a hard matter to get young wood in late years perfectly sound. From this experiment, he was inclined to believe that location has much to do with the determination of this question.

Dr. McMurtrie. You say the rich land was on one side, and the poor on the other, which you manured. You put manures on and you did not get a large growth of wood on one side. It is well known to students of vegetable physiology that where nitrogen exists in large quantities you may have extended leaf and large wood growth without the proper adaptation for fruit production. You may exhaust the vines of the principles necessary for preparing the bearing qualities of the vine. But the remedy in one case, by the use of your constituents, will not necessarily produce the fruit. In the case where you found the condition on one side to furnish very fine wood growth, you have the other condition of no fruit. Yet the leaf would, through the application of your fertilizer, be sufficiently grown, though not what is necessary for the fruit production. Economic conditions meet all the demands.

The convention, after some further discussion, at which no new points were elicited, was announced adjourned for the usual recess.

The convention was called to order at 3 o'clock. After some discussion of an unprofitable nature it was suggested by Professor Riley that some of the delegates speak to the question of practical wine making.

Mr. Reierson, of Virginia, spoke as follows:

Mr. Chairman: Although not prepared to properly discuss this interesting and important question, rather than it shall go by default, and with a view to drawing out others, I am willing to make the initiatory move, as I shall at the very threshold probably strike some one with conflicting ideas. I will therefore attempt to indicate a crude outline of the manufacture of the fruit from which we get a *pure* wine.

The first principle I would suggest for the making of wine out of grapes, is *absolute cleanliness* from the beginning, to be kept up to the very time when it is consumed, even though that be twenty years. I want the grapes cleanly picked, cleanly delivered, cleanly handled, ground with clean rollers, run into clean tubs, fermented in a clean vat, that vat cleaned when drawn off, the must again fermented in a clean cask, racked into another clean cask at proper times, on a clear, bright day. When ready for use I want it put into a clean bottle, stopped with a clean cork, that cleanly drawn out with a clean corkscrew, the wine poured into an absolutely clean glass, thin and of pretty good size, and drank with a clean mouth.

I consider that the very elementary principle essential to making good wine out of any grape, is cleanliness. The neglect of this at any stage of manufacture is, in my belief, ruinous. When thus neglected, no matter how good the grapes were originally, the wine is injured and you can clean it no more.

The simple process that I am familiar with in the making of pure wine has no mystery in it, though a great deal is attempted to be attached to it. It is true I have had but slight experience, but I have watched the mode and manner of its treatment very carefully for six or seven years, and the processes pursued by us with success. Notwithstanding it is simple, it is not always attended with success. The first question is as to the time necessary to ferment on the husk, if at all. This will depend on the kind of wine to be made—whether claret (red) or white wines. Whilst these differ, and different kinds of even red grapes require a different treatment, yet they are all simple as to each. In this respect, up to the present time, there is more uniformity in the adopted American wine grapes than those in Europe; hence the process of manufacture is less diversified. Still, in France, where I am informed that the kind and character of grapes differ at a distance of but a few miles, even distinctly differing on the respective sides of a river, each little vineyardist makes his own must, which is sold to brokers from the large city cellars, who, being experts, tell in a moment, by the taste, whether the character of the young wine be such as by proper blending will result in the respective brands dealt in by each. Of this art of blending I am ignorant, and shall attempt no explanation. I bring in this parenthetically to illustrate the assertion that the making of pure wine—that is, preserving the juice by fermentation—is simple, each grape grower doing so in France. The blending of different kinds to bring about certain characteristics is an entirely distinct art, not so easily attainable.

We assume now that we are equipped with a proper cellar, grape-crusher, press, vats, casks, and other requisite appliances, and that the grapes are ripe. When grapes are wine ripe it means that the sugar is fully developed up to a high standard on the saccharometer. What that should be must be determined by each grape-grower, as to the kind of grape, and locality, which vary. We will say that the Norton grape should indicate 100 degrees to make a good wine. That, then, is your standard for that grape, though at times and in localities nature will develop it to 110 and over. If this be your standard, I mean that such Nortons as show less than that when tested must be brought up to it by the use of a good quality of pure sugar. The natural or added sugar is not to make a sweet wine; it is to be converted into alcohol by vinous fermentation, to such an extent as experience has shown, to bring about the most pleasant results, when mingled with the other constituent elements in a given kind of grapes. If, as is probably the case, there be too large an amount of acid in such grapes as are not perfected by nature, then that excess of acid must be diminished by the use of water. I am now touching upon ticklish ground, where there is a vast diversity of opinion, and controversy is endless. I hold that water should not be added to perfect grapes, and the minimum amount only to those that require the aid of sugar. This is honestly combated by a large class; they insisting that all our grapes have too much acid; that a liberal use of water is actually an improvement, resulting in better wine; that many of our wines are too full, made pure out of the perfect juice alone, fermented. This idea, in my opinion, has been and is being practiced largely in the West, to a ruinous extent, for the good reputation of our native wines. During the past fall I have seen Norton must so treated that instead of a very dark it came out a thin bluish fluid, without a particle of its elegant characteristics being perceptible either to the sight or the taste. This they call Gallizing! Dr. Gall never taught nor practiced any such drowning-out principle. His whole idea and method was to make the best wine out of the *imperfectly ripened* grapes, so often encountered in Germany, by the limited use of sugar and water. He did not *immerse* finely ripened grapes, as his so-called followers are doing.

Having now explained the idea of a standard and its regulations, I will take the Norton for illustration. The grapes should be gathered when perfectly dry, not with rain or dew on them. Let them be brought to the cellar as speedily as practicable after gathering. They are next run through the crusher, simply to break the skin, not to crush the berry or seed. This is to facilitate the fermentation in the vat, into which they are now thrown. The white wines want a different treatment here, but I will only carry through the process of the Norton.

When the skin is broken they do not go into the press, but the fermenting vat. These, of course, vary in size according to the extent of your operations; but a large one is preferable to the smaller, the fermentation being more perfect, especially in changing temperature, and the quality of the must more uniform. September and October is the time with us for this work.

A MEMBER. What period of fermentation should they go through?

Mr. **REIKERSON.** No specific rule can be laid down as to time. That time and circumstances that had once yielded a good result should be adopted. The temperature desired at this stage I would designate as 70 degrees, with which, continued about or not exceeding 72 hours, brings about fine results, under my observation. The exact time must be determined by the character of the fermentation and the smell and taste of the must. Right here is where the character and quality of the wine is determined, and consequently this is the main point for the exercise of skill and judgment. In this process of fermentation, as the liquid is eliminated from the berry it sinks, and the husk rises to the top. If allowed to so remain the action of the air on it would rapidly develop acetic acid, which would *ruin* the entire contents for wine. To prevent this these husks must frequently be pressed down by a wooden maul, so as to be covered by the fluid; to aid which a false bottom may be used, fastened down at the top, and perforated with a number of holes to permit the escape of the carbonic acid gas developed. Whilst I designate 72 hours as the limit of fermentation as stated, and the necessity of pressing down the solid mass of husks rising, yet I have seen in the West what I was told were Norton grapes that had fermented for three weeks, and was expected to continue for three weeks longer. In these there was no need for labor to keep down the husks, for they had plenty of liquid to swim in without rising in a mass. This was perfect baptism, which I do not indorse. Some Nortons said to be thus made I drank, and found it fairly good, but not by any means what a Norton should be and can be made.

When the husk fermentation in the vat has reached the stage indicated the liquid must be drawn off through a spile hole near the bottom of the vat. To facilitate this, keeping it free from seed, &c., a bundle of grape-vines has been placed inside the vat, at the bottom, against the spile-hole, kept in place by weights. This operates as a rough strainer in drawing off the fermented must. This is now conducted by a hose, with copper strainer to hold back any grape seed that may be in it, to a well-cleaned and fresh cask, to continue its vinous fermentation. This is very violent, and therefore the cask cannot be filled. Still it should be so near full that the solid matter brought to the surface by fermentation may escape by the open bung-hole. This bung-hole is kept open till the fermentation grows gentler. Then the empty space is filled up, the bung inserted, through which a metal or rubber tube has been run, in the shape of a siphon; a half-gallon fruit glass jar filled with water is placed on the top of the cask, and the other end of siphon inserted in the water. This is to permit the carbonic acid gas to escape and at the same time exclude the air. A bag filled with sand, placed on the bung-hole, may be used instead of this siphon, but probably not so satisfactory. The young wine or must is now in the cask safely fermenting, and to be so continued till the gas cease to escape through the water-jar. Then fill up and put bung in. Evaporation is heavy now, and the cask wants constant watching and filling up.

From this point till consumed, with continued cleanliness, the principle is, *keep the cask, barrel, keg, demijohn, or bottle* ALWAYS FULL. All the liquid in the Nortons has not been drawn off from the vat; there is a considerable quantity in the husks. These must be taken out and pressed in the wine-press. The same process applies to Concord, except that some never press them at all, taking only the must that is liberated in the fermenting-vats. Generally, however, this process holds good as to all red-wine grapes.

At the season of the year when grapes are pressed here there is such a fall of temperature, naturally, that fermentation in cask is not completed, and consequently the unconsumed yeast-spores lie dormant till the heat of spring or summer puts them in motion, causing a larger or smaller amount of secondary fermentation. This is sometimes dangerous, tending to acetic instead of vinous fermentation. It is to be avoided if practicable, and, to this end, some cellars are provided with steam or water heating apparatus, to keep up the temperature artificially long enough to continue the original fermentation till completed. To this use of artificial heat I see no objection, as it is but an *aid* to *nature*. If not done the period of winter or cold weather is lost, the wine making no progress, except the deposit of sediment. It hastens maturity of the wine for use, but it is asserted that it diminishes its keeping qualities. Under favorable conditions the wines in the cask by December or January have deposited their first lees. This deposit of tartar, fermenting substances, coloring matter, salts, &c., is nothing but a natural clarification, and the clear wine should be drawn off. The sooner this be done after deposits are made the less liable are the wines to subsequent or secondary fermentation. They are put in a fresh, clean cask, perfectly filled, and so kept till say March or April, when they should be again racked or drawn off from any further precipitation of lees.

If no artificial heat be used, and the best treatment be given, then the wines should be again racked in June and September. The quality of the wines will differ the same season, made the same time, subjected to the same process, and out of the same grapes. Why this is so there is no explanation that is satisfactory. Its maturity may be hastened by frequent careful rackings, the change into smaller casks, and clarifying with eggs or gelatine. For clarifying, by which I mean the separation of all solids from the liquid, especially white wines, the filtering process is the best. Filtering, in some form or other, has been practiced as far back as we have any account of wines; but the modern resort to the use of filtering is the most satisfactory when required for large quantities. Many appliances for utilizing this most economically and expeditiously have been invented in Europe. A perfect filterer has been a desideratum diligently sought after, and now nearly, if not quite, reached, through the stimulating effect of our newly awakened interest in grape culture in the United States. Mr. Charles Farciot, now superintendent of the Kelley's Island Wine Company, in Ohio, is the inventor of a filterer, largely used in the West, some in California, and even taken to France, far superior to anything else of this kind. They are charged with as much as two or three barrels of filtering paper, through which may be perfectly clarified from three thousand to ten thousand gallons with one charge. It can be so simply placed in a cellar that, with the aid of a large receiving-vat, a force-pump, and hose, thousands of gallons may be moved from a given lot of casks, and the wine returned to those adjoining, with one single laborer at the pump; its clarification above the cellar being perfected, and return to new casks below being carried on by the simple, natural law that *liquids will seek their own level.* I perceived one difficulty, which was making a good charge of the filtering papers, so as to present a uniform and compact surface, which would not be broken through by the pressure of the liquid. If broken in one place the entire charge went for nought. This he admitted was a difficulty; his skill was acquired by practice, and even then there would be an occasional failure. This, however, he thought he had overcome by a new modification, which would enable any careful man to charge it. The first and only one of these he had at work in November, 1881, which, if it has verified his expectations, will be *the* great labor-saving machine to the entire wine world.

With this imperfect general outline, I will close with this injunction to all wine makers: Be pure; be clean; be full. If not so yourselves, apply it to your wines, vats, and casks.

Mr. PORTER suggested the adoption of a resolution looking to a reform in the nomenclature of wines and a concert of action in this direction.

Mr. SAUNDERS thought that it would be impracticable to take any steps in that direction, as the trouble alluded to was being quietly overcome.

Dr. MCMURTRIE agreed with Mr. Saunders, and advocated a plan which should indicate whether the wine was red or white, sweet or dry, and then the name of the manufacturer, letting that name be the characteristic of the wine.

After some further discussion, Mr. Porter moved that the convention adjourn *sine die*.

On motion, the thanks of the convention were extended to Professors Riley, Saunders, Taylor, and McMurtrie for their valuable service during the sittings of the convention.

Mr. FOSTER, of Ohio, offered the following resolutions:

Resolved, That this convention thank Commissioner Loring for calling us together, for in doing so he has brought all sections face to face, and enabled us to give and receive ideas and methods relative to the management of all our varied interests pertaining to agriculture.

Resolved, That we believe that the continuance of these annual national conventions would be wise, either in Washington or elsewhere, and that they should be called by the Commissioner of Agriculture and under the auspices of the Department of Agriculture.

Resolved further, That we will give Commissioner Loring our hearty support in his efforts to make this department the grand and useful one it will be to all interests of our land while under his management.

The resolutions were unanimously agreed to.

The PRESIDENT, rising to put the motion of Mr. Porter, referred at some length to the difficulties that have always attended the manufacture of wine in different countries. From the knowledge he had gained of its manipulation everywhere, he had come to believe it to be a question of ingenuity. Professor Riley could tell us all about insects that attack the vine, but nothing of the causes that contribute to the difference that exists in the results obtained from the several manipulations of the juice of the grape.

The President concluded as follows:

In putting to you the motion of Mr. Porter, which is to dismiss this body, I cannot refrain from referring to the good results that have attended this series of conventions, nor from congratulating myself upon the work you have accomplished. I congratulate the country upon the valuable papers that have been presented here, some 18 in number; I congratulate the gentlemen who have been able to be present with us and to listen to them; and I congratulate and thank the gentlemen who have furnished us with the valuable information contained in them.

When I issued the call for this convention I felt confident that the agricultural colleges of this country were in full and hearty accord with each other, and I felt sure, moreover, that there was more capacity, more ability, and a greater desire for investigation among the agriculturists of this country than they themselves were aware of; that there was more science at work among them than the farmers knew, and that the great agricultural communities of this country had, by continued processes, been stimulated to that point where they were equal to all the demands made upon them.

We have had a convention devoted to the agricultural colleges and educational institutions of the country, and I have scarcely ever listened to a better discussion than was had during this series. We have had a convention devoted to the animal industry of the country. Following this was another series, at which the cereals were discussed, and intelligently, too; and now we are about to close a two days' session upon the horticultural and vinicultural interests of the country, and no better commentary could be passed upon this last convention than is found in the interest which has never flagged for one moment, and the reluctance with which the motion is made that we now adjourn.

There have been, as I say, some 18 valuable papers read at these conventions, and I am sure there cannot be found among them all a paper unworthy of a place before the best agricultural college on earth.

I hope the assembling of these representative gentlemen from all parts of the country will be followed by the good results I anticipate, and, should we have another convention at a future time, I trust that every State in the Union will be represented as ably as have the twenty at this series, and that ere that time agriculture will have taken one more step in that progress which it is destined to make.

To the delegates who have responded to this call I owe my thanks for the various contributions to the success of the past eight days; and now, wishing you all a safe and happy return to your homes and families, and assuring you that you take thereto my best wishes for your health and prosperity, I declare this convention adjourned without day.

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